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Modern Refrigeration & Air Control

No. 721 APRIL, 1958 Price 2s. 6d. monthly

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Our Associate Company The Haslam Foundry & Engineering Co. Ltd., published this advertisement on the front cover of the first issue of The Cold Storage & Ice Trades Review (now Modern Refrigeration). In 1898 both Haslams and Sternes had already had many years of experience in Refrigerating Engineering.
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MODERN REFRIGERATION

and Air Control News

Incorporating
COLD STORAGE AND PRODUCE REVIEW
and ICE AND COLD STORAGE

Established 1898

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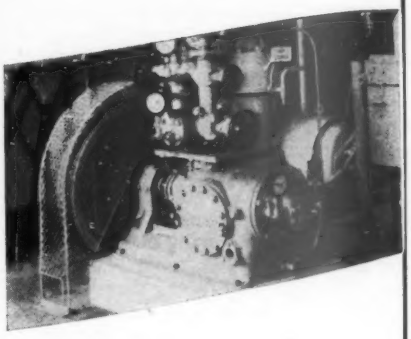

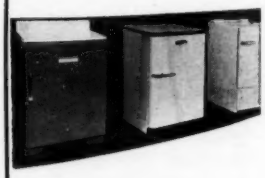

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THEODORE A. RAYMOND

Advertisement Manager:
J. A. Hutchinson

MODERN REFRIGERATION *overseas*

The world-wide circulation of this, the original and oldest Journal of the British Refrigeration Industry, carries "MODERN REFRIGERATION" by postal subscription into the following countries:—

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"M.R.", now in its 61st year of publication, has built up for its overseas readers special subscription and sales agencies in all the above territories.

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VOLUME 61 NUMBER 721

April . 1958

Editorial . . . .

We are 60

The late Joseph Raymond

● This issue is steeped in the past. Being our diamond jubilee number, we could not refrain from putting into print much data that has lain for a long time in the industry's archives. To those readers who have no taste for the historical approach, we apologize at once, for by the time that they have reached page 432 (if they ever do) their patience will be exhausted. But we believe that the majority will find much of interest within these covers, for our contributors have given unstintingly of their knowledge and experience.

● What other industry of such relatively tender years could have built up such a record ? Men of extraordinary vision and enthusiasm were attracted to the industry in its pioneering days (and, we are sure, they still are, although it is so much harder to stand head and shoulders above the rest, in this age) and the twentieth century opened with a formidable line-up of giants. Being a maritime nation it was perhaps natural that Britain should have provided a very full share of leading inventors in the refrigeration field in the Victorian era, for the perfecting of the methods of perishable produce carriage was the main concern of these pioneers.

● We have not confined our data-gathering, however, to these shores and we present some historical tit-bits from the U.S.A., Australia, France, Belgium, Germany, Denmark and Switzerland. We have found the operation most fascinating and can promise readers that the material will be preserved in more permanent form.

● The writer's only regret in compiling this issue has been that the one who was mainly responsible for the success of this journal did not live to see the arrival of this jubilee. Refrigeration was his life and his enthusiasm for the future of the industry was always exuberant. His best memorial was the warm friendships made in all quarters of the industry. This historical number will help to complete the memoirs which the late " J.R." had begun in 1954 and which it will now be our duty to put into book form in the future.

● Falling naturally into this issue is the description of the newly completed vast cold store on the waterfront at Southampton, for here is a link with Victorian refrigeration that is in character with the general atmosphere of Volume 61, number 719. The old " International " building was a model of its kind and the new structure fully measures up to the high standard expected of Britain's premier passenger port. Perhaps the outstanding feature of these premises is the system of external balconies or decks for the direct reception of goods *ex* ship, a valuable design point for speedy intake. The quaint illustration on the opposite page shows the system used, at the turn of the century, for conveying frozen meat cargoes from Southampton to London and constitutes the forerunner of our modern road-rail container idea. The more things change, the more they remain the same, is certainly true of this Victorian brainwave.

● The Brussels Universal and International Exhibition is now upon us and will be open until October 19. Many refrigeration exhibits will be seen in these vast grounds, including a complete air-conditioning system, with three 8-cylinder refrigeration compressors in the symbolic "Atomium" structure. To meet an increasing demand from architects, air-conditioning engineers and industrial users of chilled water, our friends at Abbeydale

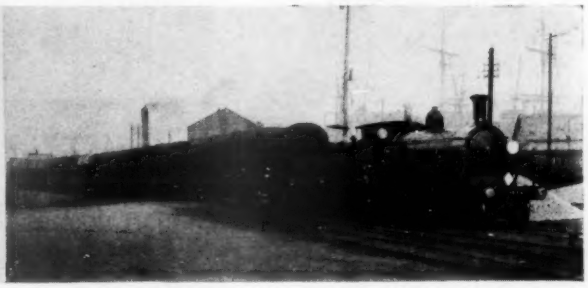
Road, Wembley, have developed a new range of packaged water-chilling equipment. These units are available in graduated capacities from 10 to 100 h.p., and are specially designed to save space, and to reduce installation time and expense to the minimum. The smallest unit in the range, which has overall measurements of 6 ft. × 4 ft. × 3 ft. 9 in. high, is being shown for the first time at Brussels, in the engineering centre in the British Industries Pavilion. British domestic refrigeration equipment will also be on display.

● In Wisconsin, a family has been sunbathing outdoors in zero weather with the aid of aluminium foil reflectors. This is only one example of the use of the unique thermophysical properties of aluminium opening up broader vistas for new products, creating more sales and markets. It is predicted that these thermophysical properties may prove eventually to be more important than the metal's light weight in terms of business potential. The thermophysical properties of aluminium are : Heat conductivity : it is superior to most common metals. Heat reflectivity : it is the common metal most practical for reflecting heat. High strength at low temperatures : aluminium is the lowest cost practical material for uses in temperatures down to —400° F., where the metal's strength increases. These three properties —added to aluminium's other well-known characteristics—increase strikingly the possible combinations of product advantages for future development. For several years the heat conductivity of aluminium has been a large factor in its use in such diversified applications as heat exchangers, water heaters, heating coils, dryers, cooking utensils, engine heads, finned tube unit heaters, refrigerator coils, steam condensers and steam traced piping. Under consideration are automotive applications such as radiators, engine blocks and a heat-dissipating, integral wheel and brake drum. A related operation is reflective cooling, where the flow of radiant energy is similar to reflective heating except that the action is reversed. Particularly successful has been reflective cooling of homes, offices and plants where the operation provides efficient low-cost, draft-free year-round conditioning. The system also applies to cooling of baked goods, meats and confections. Baked articles surrounded by air at room temperature have been cooled by reflection in one third the time required by forced cold air.

● In 1908 Lord Northcliffe launched at Olympia the first *Daily Mail* Ideal Home Exhibition. When opening it, the then Lord Mayor of London, Sir John Bell, said, prophetically : " The promoters of this enterprise have made history." That history now extends over 50 years. To that first exhibition there came 160,000 to an Olympia which consisted of the Grand Hall alone. Last year, 1957, to a much bigger Olympia 1,329,644 visitors paid to come through the turnstiles. Since 1908 more than 23,000,000 people have seen successive versions of the Exhibition. It has become a national annual institution and a large percentage of people who attend do so every year. It is at the *Daily Mail* Ideal Home Exhibition that manufacturers of domestic wares and equipment have developed the custom of introducing their new developments and inventions to the public for the first time. This was never more so than at this jubilee exhibition where visitors will find many of the newest developments in many fields of domestic utility. The refrigeration industry took full advantage of this facility this year.

VICTORIAN ROAD-RAIL PRACTICE !

How's this for road-rail transportation? These prints, which we recently found in the offices of The International Cold Storage Company Limited at Southampton, show, at the turn of the century, frozen meat cargoes being transported from that port in horse-drawn wagons to the goods yards. Thereat the horses were unharnessed and the wagons were placed on flat bed cars to be railed, by the London and South Western Railway, to Nine Elms, London.



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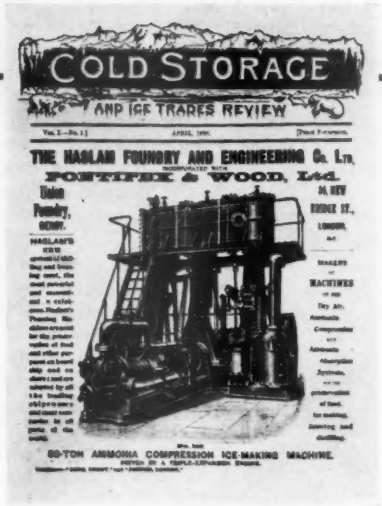
COLD STORAGE
AND ICE TRADES REVIEW
THE HASLAM FOUNDRY AND ENGINEERING Co. Ltd.
FORTIER & WOOD, Ltd.
80-TON AMMONIA COMPRESSION ICE-MAKING MACHINE.

With this April issue, MODERN REFRIGERATION marks its 60th anniversary of continuous publication. Founded in April, 1898, as "Cold Storage and Ice Trades Review," the journal bore the intermediate title of "Cold Storage and Produce Review" for 29 years before adopting its present name in 1939; at that date also the title of "Ice and Cold Storage," which publication was acquired in 1934, was absorbed under the new banner.

If man can be regarded as reaching old age in seven stages, it would appear to us that MODERN REFRIGERATION has, for its part, enacted four distinct roles in its growth thus far. The period 1898-1922 would seem to have covered a complete era in refrigeration, namely, one with the accent laid heavily on imported frozen meat and on improvements in marine produce carriage after the pioneer voyages of "Frigorifique" (1876), "Strathleven" (1880) and "Dunedin" (1882). Ice-making techniques were, of course, also much to the fore during "stage 1."

"Stage 2" embraced the years 1922-39. The emergence of domestic refrigeration as a separate industry, together with a great expansion in commercial refrigeration and the perfecting of special industrial applications, such as petrol refining, biochemical manufacture and medical uses, were facets constantly reflected in these pages.

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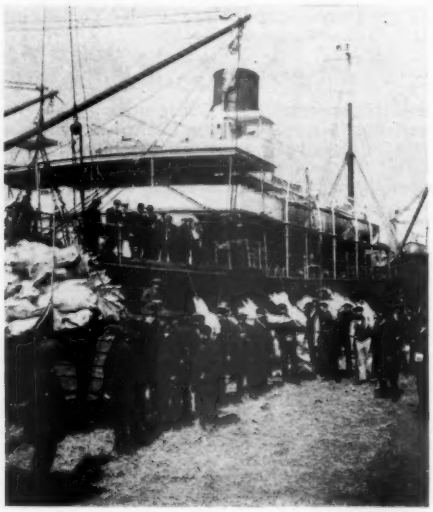


THE HASLAM FOUNDRY AND ENGINEERING Co LTD.
PONTIFEX & WOOD, Ltd.
60 years ago...
L. STERNE & CO. LTD.
50-TON AMMONIA COMPRESSION ICE-MAKING MACHINE.

60

1958

"Stage 3" spanned World War II when the refrigeration industry threw everything it had into the war effort. While enormously interesting developments took place in these six years, our lips were, for the most part, sealed and our paper rationed.

"Stage 4" has comprised a 12-year period of unprecedented development of the industry during which every record, both in home production and certainly in exports, has been smashed repeatedly. Widespread refrigeration for the food shop, the meteoric rise of the quick-frozen food trade and refrigeration's use in the atomic field are highlights of the present era.

In the simplest form, we have endeavoured to portray graphically on these two pages the "two ends" of our history—our cover in 1898 together with an illustration of frozen meat being landed at Southampton at that time : and on the right, this month's cover and a highly contemporary "shot" of refrigeration being used for research on guided missiles.

We are very proud of the fact that our advertiser on each occasion has been one and the same firm (Haslam's having been absorbed by Sterne's between the wars).

★

Portrait: Cecil Beaton

A GRACIOUS MESSAGE *from* HER MAJESTY THE QUEEN

BUCKINGHAM PALACE

Theodore A. Raymond, Esq.,
Managing Director,
Refrigeration Press Limited,
Maclaren House,
London, S.E.1.

The Queen sincerely thanks the Directors of MODERN REFRIGERATION for their kind and loyal message.

On the occasion of its diamond jubilee Her Majesty sends her warm congratulations to all concerned with its production and her best wishes to its readers.

PRIVATE SECRETARY.

April 1958.

DIAMOND JUBILEE MESSAGES FROM THE INDUSTRY

From Lt.-Col. Lord DUDLEY GLADSTONE GORDON, D.S.O., LI.D., M.I.Mech.E., president of The Institute of Refrigeration; chairman, J. & E. Hall Ltd.

I HAVE great pleasure in congratulating MODERN REFRIGERATION in having completed 60 years of continuous publication. When

my very old friend, Mr. Joseph Raymond, started the publication under the title of *Cold Storage and Ice Trades Review* he began a period of life-long service to all engaged in the manufacture and use of refrigeration. At that time ice-making, cold storage and brewing were the only important uses of refrigeration. No one visualized the tremendous advances which were to take place in the scientific development of refrigeration and the widespread uses to which it was to be put.

Through all that period of development the journal now known as MODERN REFRIGERATION has without a break encouraged and helped the progress of the industry which it continues to serve.

To have maintained such a high standard for no less than 60 years is a great achievement and it has been accomplished by progressing in line with the increase in the wide scope of the industry, at the same time as technical improvements and developments.

The publication has thus been not only of great interest but also of great help to those engaged in refrigeration either as producers or users and none of us can let this occasion pass without being conscious of the benefits we have received.

As a reader of the publication for over 50 years, I should like to give my own personal message of thanks, not only to the publication itself but to all those persons who have been responsible for producing it and who have been so well known to me over many years.

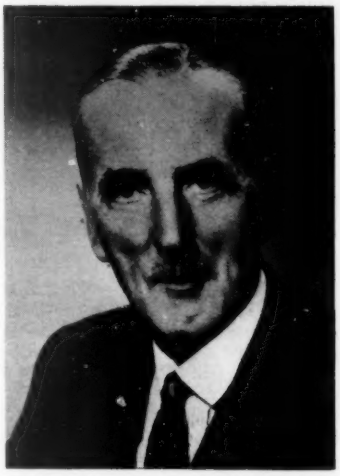
From Sir RUPERT DE LA BERE, Bt., K.C.V.O., president-elect, The Institute of Refrigeration; chairman, Hay's Wharf Ltd.

AS president-elect of the Institute of Refrigeration it gives me great pleasure to write a word of congratulation to MODERN REFRIGERATION on the occasion of its diamond jubilee, and to pay a well-deserved tribute to the valuable contribution made by your journal to the refrigerating industry in all its aspects.

Every year there are fresh developments in refrigeration and further uses are found for its employment. The ever-increasing populations of the world call for the provision of more and more food for human consumption, and refrigeration does much to prevent waste and decay. It goes further than that, and provides for food to be presented in a form which is freed from the ill effects caused by variations in temperature and climate.

Some there may be who will feel that I have not paid adequate tribute to the industry and that I have passed over lightly the invaluable research that has been carried out and which indeed is being carried out. The great value of all this work cannot be lightly dismissed—indeed it cannot be dismissed at all—but in all humility I am ever conscious that there are others who are better qualified to pronounce on these all-important matters. Countless thousands throughout the world to-day owe a deep debt of gratitude to all those whose endeavours have been concentrated on building up this great industry.

Many claims are being made as regards the improvement, advance and advantages which will shortly



be proved to be of immense benefit to mankind. The last word has by no means been said as regards the future development of refrigeration. I am convinced that the contribution made by your journal in promoting the field of knowledge of the refrigerating industry is by no means small, and in this connexion you have thereby raised the standard of living and amenities of all people.

From Mr. BASIL SANDERSON, M.C., chairman and managing director, Shaw Savill Line

IN congratulating you on your 60th birthday—a remarkable achievement—I have tried to cast my mind back to those of my earliest experiences in shipping which had any connexion with refrigeration. My experience cannot go so far as yours, nor did I necessarily meet the different types of refrigeration with which I have had contact in their chronological order.

The earliest system of which I have personal knowledge was installed in our *Karamea*, *Kumara* and *Waiwera* in the early 20s, though the system itself had been born long before then. It was the old cold air Haslam type which was perfectly adequate for the carriage of hard-frozen cargo once it was stowed, but it presented all kinds of problems in loading during summer months in Australia and New Zealand, and more particularly the former, where outside temperatures were apt to be higher. Waterside workers, in Australia particularly, were averse to and indeed refused to work in spaces where a thick fog of cold air was being introduced at very low temperatures, and the only means of meeting this point of view was to freeze down between times and then shut off the refrigerating system during loading operations, and thereafter promptly to close hatches and try and get the temperatures down again. In North Queensland in hot weather this presented insuperable difficulties, so much so that we had to regulate our programmes to avoid anything north of Sydney for these three vessels during the southern summer.

At the same time as I was introduced to the Haslam system, the Aberdeen Line and Shaw Savill's both had more modern vessels afloat with what was then considered the most modern existing system, namely, brine grids for the lower holds and what we then termed the " battery system " for carrying fruit, eggs and cheese in 'tween decks. Vessels so equipped gave us no troubles or anxieties, so much so as to lead one to wonder whether the advances that have been made since, with all their additional expense, have really been justified by the improved out-turn. I know it is heresy to make such a remark and it may be that a higher standard is now required—30 years later—by both shippers and importers, but I can remember very few criticisms indeed in the early 30s directed at the out-turn of either fruit or hard-frozen cargo, though with our modern refinements we are apt, on occasions, to have complaints, presumably because the ideal out-turn has never yet been achieved.

The next development, as I recall, was a combination of brine grids in lower holds and sheathed grids for the carriage of chilled cargoes in the 'tween decks. The latter system, when first introduced, was regarded as an advance upon the older battery system, but in effect proved a disappointment because the air currents, whether athwartships or fore and aft, were apt to follow devious courses and indeed on occasions to disregard the stack of fruit between the inlet and the outlet and instead of percolating through and between the cases, either went over the top of the block or underneath, according to whim. This sheathed grid type did not, therefore, persist for very long in our fleet, and with the intervention of the last war was superseded quite quickly by the modern battery system, with air-trunks buried in the insulation.

With this system one has the introduction of cold air at the top of the space and its extraction at the bottom, and the more forceful air circulation has eliminated a very large percentage of the battens, laths and other dunnage which was previously required. Apart from the human element one would be apt to regard the present system as more or less fool-proof, and indeed cases of indifferent out-turn of refrigerated and chilled cargoes are very few and far between. Each age is apt to regard its latest inventions as a final achievement, but perfection is never reached and nothing is more certain but that in a few years' time, some other development will have been introduced, and my successors will look back at to-day's system as being primitive and a curiosity in the light of subsequent developments. Be that as it may, it is not without interest to consider that we have so far turned full cycle as to have started with the Haslam and come back to a system which is very similar in its conception, if not in its actual application.

Systems of refrigeration, while of interest, are only of importance if they can do the job for which they are designed, and to a greater or lesser degree all those of which I have had any experience have been successful. The stimulus which led to the installation of refrigeration aboard ship and of subsequent developments came from the appetites of the ever-increasing population of this country towards the end of the 19th century. Some method had to be found of feeding the increasing numbers born of the industrial revolution, and overseas there was a ready supply of mutton, lamb and later beef which was being produced to meet a demand in the old world for wool and, more latterly, dairy produce.

The first ship ever to load refrigerated produce from New Zealand was a sailing ship, the old *Dunedin*, in 1881, and I have on my mantelpiece at the moment a water gauge from the donkey boiler, which was fitted on the *Dunedin* to drive the refrigerating machinery. The *Dunedin*, after an abortive first attempt, eventually sailed from Port Chalmers with 5,000 carcases of mutton and lamb and delivered these successfully to the London market, with the

exception of one carcase which was the only part of the whole cargo condemned—a most successful initial venture. This background has to be set against our more modern type of cargo liner which regularly delivers 250,000 carcases of lamb if loading with lamb only, or mixed cargoes of beef, mutton, lamb, butter, cheese, eggs and fruit with capacity of up to 525,000 c.ft. for the carriage of refrigerated produce.

From small beginnings the Dominion of New Zealand has attained manhood largely from the development of her frozen meat and dairy potential. Her frozen exports have expanded until they now reach the vast total of almost 400,000 tons of meat and 250,000 tons of dairy produce per annum, while the total frozen imports of this country from all over the world are in the region of 1,500,000 tons each year.

Associated as I have been for so many years with a not unimportant portion of this vast movement, I am delighted to offer MODERN REFRIGERATION my heartiest congratulations on their long and successful life.

From Mr. EUGENE RUDDIN, C.B.E., president, National Federation of Cold Storage and Ice Trades; managing director, James Ruddin Ltd.

CONGRATULATIONS on MODERN REFRIGERATION reaching its three score years.

The success of your publication is without doubt due to your awareness of what an industry requires to know and read about and in this regard you have maintained a most excellent service by up-to-date appreciation of progress.

The name Raymond has been associated with our industry for a very long time and it must give you great personal satisfaction of being in control at this moment.

To your good self, staff and MODERN REFRIGERATION—*ad multos annos.*

From Mr. T. WHITTAKER, director, British Refrigeration Association

MANY happy returns to MODERN REFRIGERATION upon its 60th anniversary.

When it was founded in 1898, the British refrigeration industry was still young. The manufacture of refrigeration equipment on a really

commercial scale was in the pioneer stage and the first British refrigerated ship, the *Strathleven*, had completed her maiden voyage not many years previously. Now the world is meshed with a chain of refrigerated warehouses, ships, vehicles and trains and the geography of food production has been revolutionized.

British manufacturers of refrigeration equipment played a great part in creating the world's "cold-chain"; they are playing a leading part in its further development and at the same time are meeting the demand for refrigeration equipment for many newer purposes such as air-conditioning and for others less well known.

An industry which has a good trade press is a fortunate one and MODERN REFRIGERATION is part of our good fortune. It is our loyal friend and close supporter; may it share in the bright future of the industry as successfully and helpfully as in its eventful past.

* * *

From Mr. EDWIN G. BATT, chairman, Marco Refrigerators Ltd.

IT is over 200 years since William Cullen, a Scottish medical man and professor of chemistry in Glasgow, first experimented in boiling ether under reduced pressure and observed a lowering of temperature. This led to the first effort to produce ice by mechanical means.

It is, however, only during the past 60 years or so that the importance of refrigeration has gradually become recognized. So far as Great Britain is concerned the past 20 years represents the period during which real progress has been made and even today the saturation level of use is unsatisfactorily low. Some people may argue that a current turnover of some nine times that of 1935 is not too bad, but what is not appreciated is the value of refrigeration, as such, to mankind.

Refrigeration today plays a part in almost every aspect of life, *e.g.*, in the home, the shops, ships, aircraft and medicine.

Whereas 20 years ago Great Britain relied almost entirely upon the importation of component parts from the U.S.A., today it is a flourishing industry, self-contained, no longer depending upon imports, but on the contrary exporting to all parts of the world.

For the purpose of these notes the subject can be divided into two parts—(*a*) the cabinet and (*b*) the operating machinery.

In the case of domestic cabinets the general design has not appreciably changed although new materials such as plastics are rapidly replacing the use of wood or metal. In detail, however, every year appears to bring the introduction of more accessories and, indeed, colour schemes. Care must, however, be taken to ensure that the supply of so many internal fitments is not

overdone as, of course, it leads to the lessening of the effective storage space which is, after all, what the user mainly requires.

Cabinets for commercial use are another story. For many years we have had cold rooms of various types, *e.g.*, "built-in," "solid," or "sectional." Today the call is for self-contained illuminated display cabinets for the storage of food at varying temperatures. These are now available in a variety of designs to suit all needs, but the refrigeration industry must take great care to see that the cabinet does, in fact, properly protect the food from an hygienic point of view. The writer has for a long time urged the paramount necessity of a British standard specification in order that the cabinet user may be able to compare tenders properly and satisfy himself later that the cabinet which he purchases does in practice properly protect his goods. It is gratifying to know that in the almost immediate future the British Standards Institution will be publishing the first specification on the subject covering "open and closed refrigerated display cabinets for the retail sale of frozen foods."

Coming to the question of the operating machinery as applied to both domestic and commercial ser-

vices, the story of development is in three stages. First, the original belt-driven, open - type compressor, secondly the hermetically sealed system, and thirdly the latest "semi-sealed" hermetic system. It is of interest that while the first and second types were of American origin and design the third is an all-British product which incidentally is now being produced by certain leading American manufacturers.

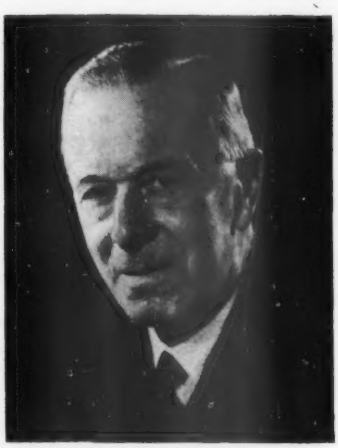
The market for refrigeration is only in its infancy, but there is no reason why in due time it should not be among the most important industries in this country.

From Sir SAMUEL R. BEALE, K.B.E., chairman, L. Sterne & Co. Ltd.

SOME 24 years before *Cold Storage and Ice Trades Review* saw the light of day, my company was operating as Thomson, Sterne & Co. Ltd., in Glasgow, although spiral springs, railway buffers, etc., and not refrigeration plant, were the main products. The present title of L. Sterne & Co. Ltd. was adopted in 1882, when my father was chairman and Louis Sterne was managing director ; the manufacture of gas engines was their main preoccupation at that time. It was, however, at a board meeting in 1887 that the first reference was made to refrigeration ; it was then agreed that Mr. Sterne should communicate with Mr. Haslam and other parties interested in the refrigerating trade with regard to the De La Vergne refrigerator and ice-making machine for which we had acquired manufacturing rights. The following year Mr. Sterne reported that he had concluded a contract with the Leadenhall Market Company for the supply and erection of a De La Vergne refrigerator. I believe that this was the first public cold-storage ammonia refrigerating plant, perhaps the first of any type, to be installed in London. I remember being taken as a small boy by my father to see it and being rather terrified at having to go so close to the moving and colossal (by to-day's standards) machinery. In the years that followed many such machines were supplied, and two of the earliest of these De La Vergne compressors are still in service in Smithfield.

On leaving Cambridge University, I started as an apprentice in the pattern shop at the Crown Iron Works, Glasgow, in 1903, so that I have had the pleasure of having been present on the refrigeration scene for well over 50 years.

The second phase in the development of the company as a producer of refrigerating plant came when Louis Sterne, on a visit to the States, bought one of the Remington Company's smallest machines, also a single-cylinder machine of the next size and a double-cylinder compressor. We studied these machines and came to the conclusion that they must be redesigned to sell on the British market because we did not think that certain features, including, for instance, the use of set pins for holding on the doors and covers, would be acceptable. We accord-



ingly proceeded to design and produce our own range of vertical, enclosed machines from the 2¼-in. by 4-in. single-cylinder to the 8-in. by 8-in. two-cylinder, many of which are still in service. I think that it is fair to say that, crude as these enclosed vertical machines were, when looked at from a present-day standpoint, they did in fact fill a much-felt want, and enabled us to do a trade which would have been otherwise impossible.

I find it difficult to maintain exact chronological order, and I should record that in 1912 my father, who had been chairman for 30 years, died. Sterne was elected chairman, which gave him tremendous satisfaction, and I was put on the Board.

In 1924, Mr. L. Chew, who had been associated with the company

for some years in a consultative capacity, was elected to the board. Three years previous, we had come to an agreement with H. J. West & Co., of Saxilby, Lincolnshire, of which company Mr. L. Chew and Mr. W. F. Jennings were directors. That agreement formed another landmark in the history of L. Sterne & Co. Mr. Chew, of course, was distinguished in the refrigerating industry for the championship of the high-speed compressor. I always maintain that we cannot express too strongly all that we owe to the late Mr. Chew for his ingenuity in design.

In 1932 the third phase in the development of the company took place when Mr. P. B. H. Brown, who was appointed a director two years later, visited North America and made the first approach to the Universal Cooler Co., of Brantford, Ontario, for the use of their design in the production of small, automatic refrigerating machines, which led to the great development of our factories at Hillington where, amongst other things, the range of Tecumseh hermetically sealed units and low-temperature cabinets are now produced.

By the acquisition of the Haslam Foundry and Engineering Co., of Derby, in 1935, the company secured a firmer footing in the marine refrigeration field, although we had supplied marine refrigeration plants even before 1900, and in the expansion of this market I must acknowledge the help of Mr. E. Walker Elliott, our director, who retired last month after having been with us since 1923.

In looking to the future, I wish MODERN REFRIGERATION continued success in faithfully recording developments in our field.

From
Mr. STANLEY BROUGHTON, managing director, Electrolux Ltd.

IN 1901, two years after the publication of the first issue of *Cold Storage and Ice Trades Review*, later to be *Cold Storage and Produce Review*, the ancestors of MODERN REFRIGERATION, there was established in Sweden, a company for the

manufacture of incandescent kerosine vapour lamps. Called "Lux" lamps they were the product of A.B. Lux.

From this firm evolved the internationally famous A.B. Elektrolux and our own British Electrolux Company.

One of the earliest Electrolux mentions in *Cold Storage* was the report in an issue of March, 1926, of a luncheon at the Savoy Hotel where Major (now Major General Sir) Harold Wernher inaugurated a "popular campaign for domestic refrigeration" with the demonstration of ". . . an invention which we think to be one of very great importance for the benefit of the trade and public" . . . the Platen-Munters ammonia absorption system.

These refrigerators were then imported from Sweden and it was not until 1927 that the Luton factory opened—a fact reported at some length in the May issue of that year —and which informed readers that output was to be at a rate of 200 cabinets a week!

Throughout the years MODERN REFRIGERATION has shown an unfailing accuracy, both in its choice of story and in its presentation.

It showed justifiable excitement when the Government decided to equip its post-war prefabricated houses with refrigerators—realising what a boost this would be to the cause of domestic refrigeration.

Electrolux eventually contributed some 120,000 refrigerators to this scheme and its extension by local authorities.

The pages of MODERN REFRIGERATION continue faithfully to reflect the post-war story of our industry.

For its 60 years of service, its impartial reporting, its leadership, for the stimulus it has given us, we at Electrolux say a sincere "thank you" and wish MODERN REFRIGERATION continued success and prosperity.

From Mr. R. G. BUNDEY, general manager, Union Cold Storage Co. Ltd.

THE cold storage industry, founded on the imported meat trade towards the end of the last century, has had a chequered career since those pioneer days and although two world wars have more clearly established, even in the lay mind, the essential part it plays in the life of the country it might well be argued that these two wars retarded its natural development. Indeed, following the 1914–18 war the industry passed through a very difficult time. There is probably no industry which more quickly reacts to the changes in the country's economic measures or to the fluctuations in world food markets. Under such conditions there was a need for caution, not the most suitable atmosphere for quick or spectacular development. In spite of this, it is worthy of note the extent to which the industry has itself widened the field of preservation of foodstuffs and other commodities and responded to the needs of the food trade.

The growth of the industry is not to be measured solely in terms of increased cubic capacity or greater occupancy; much greater value must be placed on the development which has taken place in new ideas of refrigeration for many new products which has contributed in no small measure to the improved standard of living in this country.

It was a natural sequence of events that the development of the cold storage industry should be closely associated with the imported meat trade and even today frozen meat still occupies more cold storage space than any other commodity. However, once it was established that refrigeration preserved food it was not long before active minds

were energetically searching for new business.

The Dominions and the Argentine had supplied the impetus but the whole world was now developing. The Baltic States, Central Europe, Scandinavia, Russia, China and many other countries were brought into the field of operations. Butter, bacon, shell eggs, fish, poultry and fruit gradually extended the range of temperatures employed and the types of refrigeration applied.

The introduction of refrigeration supported by the initiative and energy of the cold storage industry produced fresh ideas on how to spread seasonal food supplies over a greater consumer period. Of recent times, the quick-freezing of fruit, vegetables, fish and meat has provided the main spur to greater activity in the industry and considerable capital expenditure has been and is being introduced to provide the equipment and facilities essential to this specialized trade. It is in the quick-frozen field and low temperature storage generally that the cold storage industry has its greatest opportunity for future development.

In the latter part of the 19th century the Union Cold Storage Company Limited opened its first cold store on the River Thames near Blackfriars Bridge with the idea of serving Smithfield Market, and the company has grown throughout the years developing every kind of cold storage which it found could serve the different food trades in the ports of the United Kingdom.

In the early days it was the practice to convert suitable buildings into cold stores and even the Kings Theatre, Liverpool, was acquired and transformed into a highly efficient store through the ingenuity of the company's founders.

At the same time the construction of cold stores of multi-storied stores of the standard type was proceeded with in order to keep pace with the rapid growth of the meat, dairy produce and shell egg trades.

Of latter years the company has turned its attention to the development of low-temperature storage and its latest project is a completely palletized public cold store in Birmingham. This is thought to be the modern way of handling merchandise expeditiously and experience in other parts of the world, particularly America, has shown it to be economical and efficient. Naturally, the company has been ably served by the manufacturers of refrigerating plant and equipment with whom the closest contact has been maintained.

The Union Cold Storage Company has already celebrated its own jubilee year, and takes this opportunity to congratulate MODERN REFRIGERATION on reaching their diamond jubilee, on the growth of the journal and on the ever-increasing breadth of outlook and diverse subject matter which keep the industry informed of all the latest developments. May you long continue to expand the interest which you have created.

From Mr. W. S. DOUGLAS, managing director, Wm. Douglas & Sons Ltd.

IT is hard to imagine an industry carrying on for any length of time without a good trade journal. There must always be "a chiel amang us taking notes" and disseminating, for everyone's benefit, the information so obtained. In our industry this has been done for us by MODERN REFRIGERATION and on this, its 60th anniversary, we can fairly congratulate both the journal and ourselves that it has been done so well.

Anniversaries lead one to look back. In the present instance the looking back extends to nearly 50 years and one certainly notes some changes. Refrigerating mac ines in those early days were simple straightforward affairs, with compressors running at 100 r.p.m. or less, no automatic control, no "Freons" and (except for the quite special Linde and Claude plants for liquefying air) very little low temperature work or multi-stage working. Domestic refrigerators were non-existent.

Today, speeds are many times higher. Multi-temperature multi-compressor jobs, with flooded working and fully automatic control, are in regular use, and stratosphere testing chambers at minus 80°F. or below, with multi-stage or cascade systems, and again automatically controlled, are not regarded as anything very special. The domestic refrigerator industry is well established and has grown until its turnover substantially exceeds the turnover in industrial plants. Air-conditioning, almost non-existent 50 years ago, forges ahead. A very wide choice of refrigerants is open to us and the applications of refrigeration have become, like Sam Weller's knowledge of London, extensive and (some of them) peculiar. The contrast is indeed a startling one.

One notices, too, the welcome progress made in education and research. We have a National College and evening classes at various centres. At least a start has been made on co-operative engineering research, and in research on the preservation of food by cold storage we are well to the fore, thanks to the first class work done at the D.S.I.R. research stations, which has had such practical results.

These stations have been run up till now, within the D.S.I.R. by the Food Investigation Organization, and it is particularly appropriate to mention that body in the present context, since it was due to Joseph Raymond, who for over 50 years guided the destinies of MODERN REFRIGERATION, that the first step towards its formation was taken. This was in 1917 when, as a result of the danger to our food supply from the Kaiser's U-boats, he organized a deputation to Lord Rhondda, then Minister of Food. The deputation made a strong case for research in food conservation and from that sprang the F.I.O.

Joseph Raymond did much else to help the industry, not least by

acting as honorary secretary of the Institute of Refrigeration for half a century. It is pleasing to note that his son, Theodore, the present editor-in-chief of MODERN REFRIGERATION, carries on the tradition by serving the Institute well as its honorary treasurer, and it is a pleasure to wish him and the journal continuing success.

From Mr. C. B. H. FENTIMAN, managing director, Perfection Parts Ltd.

I HAVE had the good fortune to be active in the side of the refrigeration business which makes many

friends and contacts throughout the industry and it is a fact that the industry is a kind of a large family which goes on in association through the years.

In this appreciation the name of Raymond always brings to mind the unique and very valuable work which was done on behalf of the industry both with regard to the Institute and the MODERN REFRIGERATION journal. Sixty years seems a long time but it has been a time of continual progress.

In another capacity I am closely connected with the world of advanced electronics where one constantly hears of simulated tests. In refrigeration it is not new—I remember 30 years ago carrying out a simulated test on a refrigerated wagon for an Indian Railway with all the starts, stops, temperatures and other features such as would be involved during an actual train journey through India.

I know that not only in this country but all over the world refrigeration engineers have their common ground in their profession and it is this common interest sincerely expressed which makes the industry not only a business but a well-founded and pleasant occupation. It is to my mind a very fortunate circumstance of the growth of the industry in this country that we should have had the benefit of the long service of the late Mr. Joseph Raymond and of Mr. Theodore A. Raymond, who have so ably created a continuity of service both to the official and journalistic aspects of the industry, and I have no doubt that everybody will add to their congratulations their sincere wishes for many further years of unbroken service.

From Mr. E. M. HEAP, joint managing director, York Shipley Ltd.

IT is impossible for one who has been in the refrigeration industry from pre-war days to send birthday greetings to MODERN REFRIGERATION without thinking of the name of Raymond. It is 60 years since *Cold Storage and Ice Trades Review* appeared and, from that date until his death in 1954, J.R's active and enthusiastic support for the industry never waned.

The pages of the journals are full of vivid reminders ; *Cold Storage and Ice Trades Review, Cold Storage and Produce Review, Ice and Cold Storage, Modern Meat Marketing,* MODERN REFRIGERATION, *Quick-Freezing* ; The British Cold Storage and Ice Association, The British Association of Refrigeration, The Institute of Refrigeration and technical membership status ; Institut International du Froid, the International Congress in London 1924 ; Refrigeration Manufacturers' Association, "Arctic Circle" ; Food Investigation Board ; technical education ; good journalism but with so much more in broad vision and creative work.

With such a history to challenge and inspire, MODERN REFRIGERATION under the guidance of its editor, a son and partner of J. R., can look forward to many happy anniversaries as it continues to serve an expanding industry, an industry, which has, as yet, barely realized its own great potentialities.

From Mr. H. G. JAEGER, director, Chambers Wharf & Cold Stores Ltd.

IT gives me the greatest pleasure to contribute to this very special edition of MODERN REFRIGERATION, and to offer my heartiest congratulations on the celebration of its diamond jubilee.

The publication of MODERN REFRIGERATION continuously for 60 years is an achievement which Mr. Theodore Raymond, the managing director and editor, can be justly proud.

He has carried on so successfully the tradition established by his father, the late Mr. Joseph Raymond, who played such an important part in the development of the industry and its Association, later to become the Institute of Refrigeration.

I have been a regular reader of the journal for over 35 years and it has always proved most interesting reading and has never failed to provide the lead and inspiration expected from the trade's foremost publication.

The progress of the industry during the life of MODERN REFRIGERATION has been phenomenal, the development of food preservation to the sub-zero temperature ranges has been a singular contribution to living standards and food hygiene, and in the industrial field it is probably associated at some stage with most manufacturing processes.

These important facts need to be brought to the public's notice and an enterprising trade journal can play a paramount part in this respect. With the accelerated pace of industrial development in all its phases, refrigeration has an even greater part to play, and I am sure no little contribution to this will continue to stem from the pages of MODERN REFRIGERATION.

From Mr. E. T. JONES, managing director, Dean & Wood Ltd.

MAY I offer my sincere congratulations to MODERN REFRIGERATION on reaching its diamond jubilee of continuous publication.

I have been associated with our industry for over 40 years and watched its progress, which has been remarkable on all sides.

It is impossible to assess the technical improvements which have taken place, without reference to MODERN REFRIGERATION as our journal, which has advanced fully with the times and done everything it possibly could in every direction for the refrigeration trade in general.

I do hope you go forward from success to success.

From Mr. L. O. LAWRENCE, sales manager, Winget Ltd.

NO one, I believe, would deny that during the years which have passed since the end of the last war, MODERN REFRIGERATION has well served the industry, the name of which it bears. The period covers but one-fifth of your journal's life and, although my own experience and use of it extends only since 1945, I have no doubt that it has proved increasingly valuable from its birth 60 years ago : I wish it every success in the future.

Some of us, perhaps, in the daily hurly-burly of this fascinating business of ours, are apt to forget the importance of refrigeration to the world at large : your journal serves to remind them of this and of the fact that we have a healthy and expanding industry which can be justly proud of its by no means insignificant position amongst others which contribute to the increasingly higher standard of living of innumerable people in many parts of the world.

All who are engaged in commercial and industrial refrigeration have seen important progress in these fields during the post-war period : great strides from small beginnings pre-war, and during the war, have been made in, to mention only a few instances, quick-freezing through all its aspects, in ice cream manufacture and sale, in low-temperature transportation, in air-conditioning and in water chilling. In all these, MODERN REFRIGERATION through its editorial and advertising columns, has played its part.

Comparatively little progress, however, seems to have been made in this country in the medium-temperature range of refrigerated transport for fresh food. Would it be out of place here to suggest that MODERN REFRIGERATION might, to the ultimate benefit of operators and consuming public alike, stimulate interest in this apparently rather neglected outlet for refrigeration plant by, say, publishing a symposium on the subject ?

From Mr. KENNETH LIGHTFOOT, O.B.E., chairman, The Lightfoot Refrigeration Co. Ltd. ; chairman and managing director, Lightfoot Cold Stores Ltd.

DURING the lifetime of MODERN REFRIGERATION the refrigeration industry has passed through a period of complete change, both in regard to the design of refrigerating machinery and to its principal applications.

In the 1890s the majority of compressors were of the open horizontal slow-speed design running at from 50 to 120 r.p.m. Condensers were mainly of the open-air type consisting of sheets 20 ft. to 40 ft. long made up of interlaced coils, and only for the smaller sizes of plants were submerged or double-tube condensers used. A typical steam-driven brine-cooling plant of 1898 had an ammonia compressor running at 75 r.p.m. direct coupled to a steam engine capable of developing 35 indicated horse-power, both the condenser and the refrigerator consisting of coils being submerged in circular steel tanks.

At that time the principal users of refrigeration were breweries, ice factories, cold stores, dairies, and ships bringing frozen meat to this country. Steam engines were used almost exclusively as the driving power, electric motors being used only for driving the smallest sizes of plant.

With the exception of marine installations and small cold storage plants for butchers, hotels, etc., for which carbonic acid was generally used, ammonia was the refrigerant in universal use, the range of evaporating temperatures lying mainly between minus 10 and plus 30° F.

Generally, these conditions continued through the first 20 years of the present century without any changes of outstanding importance. The speed of ammonia compressors, which were still of the horizontal open type, was increased first by some 30 per cent. through the use of lighter-weight hollow-spindle mushroom-type suction and delivery valves and, subsequently, to 200 to 300 r.p.m. when mushroom valves were replaced by ring plate valves which were sometimes arranged circumferentially at each end of the cylinder instead of in the end covers. As driving power for the larger sizes of plants steam engines were, to a considerable extent, superseded by gas engines with their own gas producing plants, while there was an increasing use of electric motors for plants of small and medium capacity.

The first world war did not have any great impact on the refrigeration industry in the sense of demanding any special applications of refrigeration. At home more plants were required for the manufacture of explosives and for extensions of cold stores, while considerable numbers of conventional ice-making and cold storage plants were sent to subtropical war areas such as Mesopotamia.

The 1920s were probably the most significant decade in the history of mechanical refrigeration. In this period came the introduction of the vertical, enclosed-type compressor running at speeds of 300 to 400 r.p.m., and while as a compressor this design of machine had a lower volumetric efficiency than the horizontal compressor which it replaced, it was very much more compact and enabled a change to be made from wet compression to dry compression, resulting in a material improvement in the overall efficiency of the whole refrigerating plant. At this time shell and tube condensers, with their higher rate of heat transfer, began to take the place of the open-air type, and flooded systems to be used on the evaporator side. Ammonia continued to be the refrigerant principally in use for industrial refrigerating plants.

Although, when it made its first appearance in this country, about 1925, its significance was not fully appreciated by those who had been for many years connected with the industry, the domestic refrigerator embodied two factors which were destined to have far-reaching effects on future developments of all types and sizes of refrigerating machinery. These were, first, the automatic control of the flow of liquid refrigerant and of the running periods of the plant to suit the temperature requirements inside the refrigerator rather than the working hours of the attendant, and, secondly, the departure from the established refrigerants in favour, first of sulphur dioxide, and then in turn, methyl bromide and methyl chloride, and eventually the later halogenated hydrocarbon refrigerants best known under the trade names of "Freon" and "Arcton" which are now so largely used for commercial and industrial refrigeration all over the world, as well as for domestic refrigerators.

The success of the automatic units used in domestic refrigerators quickly led to similar units being used for small commercial applications such as ice cream conservators, service cabinets and small cold rooms, and as a result of this and the countrywide sales and service organizations set up by the firms supplying domestic refrigerators, a very large and previously untouched field for small refrigerating plants was opened up.

The most noteworthy development which took place in regard to refrigerating plant during the 1930s was again in connexion with small machines. In the earliest domestic refrigerators normal belt-driven enclosed-type compressor units requiring glands were used with sulphur dioxide, methyl bromide or methyl chloride as the refrigerant, all of which gases are nauseous and in some degree toxic, and it was soon appreciated that, if the use of domestic refrigerators was to become universal, it was essential that the need for service after installation should be eliminated, more particularly that arising from leakage of refrigerant, and that the best way to ensure this was by having a refrigeration system which, after dehydration and charging with the exact quantities of dry oil and refrigerant, could be completely sealed by welding or brazing at the factory before delivery.

The original sealed units were of very small capacity, the motor being of $\frac{1}{4}$ to $\frac{1}{6}$ h.p., but since then both the applications and the capacity of this type of machine has been expanded and hermetically-sealed units are now made up to a capacity of 5 h.p., and utilized for a wide range of commercial purposes, particularly for air-conditioning.

During this same period an outstanding new application of refrigerating plant was in connexion with the manufacture, distribution and sale of ice cream produced in a number of large centralized factories from which it was distributed to all parts of the country. It was at this time also that the control of the temperature and humidity of air, which came to be known as air-conditioning, and which was to

become such a very important field for refrigerating plant, was being developed in the United States, where the climatic conditions were particularly favourable.

The 1940s were, of course, overshadowed by the second world war. Apart from a very considerable demand for refrigerating plants for conventional uses such as cold storage, ice-making and water cooling, refrigeration was called upon to perform new and vital services to aid the war effort, such as the freeze drying of penicillin at temperatures of from minus 60° to minus 90° F., cooling aluminium alloy rivets and parts of aircraft to minus 40° F., in order to normalize the hardening reaction which would take place at room temperatures, the production of arctic conditions for testing out guns, ammunition and machinery, cabinets for the storage of blood, and cooling air on a large scale in connexion with testing out aircraft designs in wind tunnels.

The use of refrigerating plant as heat pumps received considerable attention in countries like Switzerland, where imported fuel was extremely expensive if not unobtainable, and many plants of considerable capacity were installed for this purpose.

In the 1950s outstanding developments requiring refrigeration have been the great expansion which has taken place in the freezing, storage, transport and retail sale of quick-frozen foods, and in the use of air-conditioning plants of all sizes for purposes of human comfort and efficiency, mainly in tropical countries, and in temperate countries for controlling the conditions in which certain industrial processes are carried out.

From the design point of view the trend in refrigerating plant has been similar to that of practically all kinds of reciprocating machinery—greater compactness and lighter weight. In the case of refrigerating compressors this has been achieved by the use of numbers of relatively small cylinders grouped in " V " or " W " formation with two, three or more cylinders operating on each crank, and running at speeds varying from 750 to 1,500 r.p.m., making direct coupling to electric motors running at synchronous speeds a practical proposition. In the case of condensers and coolers, compactness has been effected by improving the heat transfer by the use of fins and by keeping the evaporator surfaces clean and free from ice and snow by automatic defrosting, whilst to offset high labour costs automatic control is being increasingly used.

During the last 10 years a number of compressors of the centrifugal type have been installed, but owing to the inherent characteristics of this design of compressor they have, so far, only been constructed for units of fairly large capacity and where the working conditions require only a relatively low ratio of compression.

As regards refrigerants in general use in 1958, while ammonia is still the refrigerant principally used in large industrial installations, it has, to a great extent, been replaced by the various halogen refrigerants such as " Freon " and " Arcton " in small- and medium-sized plants, whilst carbonic acid is now used only under special circumstances.

The range of evaporating temperatures, which varied between minus 10° and plus 30° F., in 1898, has widened to minus 110° and plus 45° F., in 1958.

Electric motors, either through vee-belts or direct coupled, are almost universally used as driving power.

Looking back over the past 60 years, the story that MODERN REFRIGERATION has recorded during its lifetime is one of progress and expansion in every aspect of refrigeration—technical knowledge, manufacturing skill, and the purposes to which it has been applied in the service of mankind.

From Mr. G. YATE PITTS, director, B. Jaquiss & Sons Ltd.

AT the turn of the century cold storage was mainly centralized and cold store buildings were comparatively few and relatively large. Coupled with cold storage it was usual to find ice manufacturing on a considerable scale for the purpose of supplying the fishmonger's slab and the butcher's ice box. The latter were mainly small affairs although some were of the walk-in variety.

Twenty-five years were to pass before the newer refrigerants possessing lower condensing pressures accelerated the decentralization movement which had begun slowly in the early 1920s. These new refrigerants made possible the individual ownership of cold chambers by the whole field of industry and commerce and served to satisfy the steadily increasing demand for cold rooms for the widening range of specific purposes.

At the end of last century the insulation of cold store buildings consisted almost entirely in the

provision of a timber lining to the building which retained a loose-filled insulation of some kind. The construction consisted either of single or double boarding on each side of timber framing with or without the inclusion of waterproof paper. This arrangement applied to walls, ceilings and floors and was of course facilitated by the general use of timber joists to form the load carrying floors of a building. Insulants included silicate cotton, slag wool, charcoal, sawdust, granulated cork, regranulated cork and one or two other materials of but little interest. About this time moulded cork slabs of the agglomerated and impregnated varieties were also in evidence but more on the Continent than in this country. These were soon to be superseded by baked corkboard which had emerged in America by 1907 and came into general use in this country immediately after the 1914–18 war. Baked corkboard is still very widely used in the insulation of cold chambers, but was joined a

few years later by expanded ebonite slabs and after the 1939–45 war by polystyrene slabs.

The rule-of-thumb methods which had been so evident around 1900 were gradually giving place to a more scientific approach to the problem. Information was being accumulated slowly but an important special report (No. 35) of The Food Investigation Board of The D.S.I.R. was published in 1929 containing the collated information on the physical properties of many insulants which had resulted from the labours of Dr. Ezer Griffiths and his colleagues at The National Physical Laboratory. It is now generally accepted that the physical properties of any insulant offered should all be available to purchasers.

The lowering of storage temperatures particularly for the longer storages demanded during the 1939–45 war brought further problems particularly in the matter of frost heave in the sub-soil under cold store buildings. Electric heating mats for the prevention of frost heave have now become commonplace. Further, the effect of the partial pressure of water vapour in the atmosphere has become more clearly understood and the deterioration of insulation consequent upon the migration of atmospheric moisture, under the influence of temperature difference, has been both studied and catered for by the incorporation of vapour barriers.

The earliest type of simple bevel door gave way to a lighter type of door, which although of the bevelled type, had sufficient clearance between frame and plug to avoid the physical difficulties of the earliest doors. Subsequently, doors of the super-freeze type came into use where very low temperatures would occasion freezing up of the door to the frame. A further refinement in this connexion is the provision of electrically heated strip to avoid altogether the troublesome deposition of frost.

From Mr. A. W. PORTER, general manager and director, Frigidaire Division of General Motors Ltd.

IT gives me considerable pleasure to be able to convey my congratulations to MODERN REFRIGERATION on the occasion of their 60th anniversary. The achievement in reaching such a milestone as this is indeed considerable.

We at Frigidaire know something about pioneering in the field of refrigeration and it is, therefore, particularly pleasant to be able to look back in company with another pioneer at the colourful history of refrigeration and at the part we have both played in its making.

To-day the refrigeration industry in this country is not only well established but is striding ahead at an ever-increasing pace. Great new developments are in progress, vast new potentials are being uncovered. Those of us who are engaged in this exciting business of ours must express our gratitude that in MODERN REFRIGERATION we possess a mirror in which we know the reflection of our progress will continue to be so accurately and comprehensively recorded.

From Mr. C. R. PURLEY, chairman, Lec Refrigeration Ltd.

AS chairman of Lec Refrigeration Ltd., it gives me great pleasure to extend my company's good wishes on the occasion of MODERN REFRIGERATION'S diamond jubilee.

Lec has only been in existence one-quarter of that time and, on many occasions, our own rapid expansion has been aided in no small degree by your very fine journal.

Many of the articles have proved of great assistance to Lec technicians, while snippets of information culled from its brightly written pages have often paved the way to increased business or improved production methods.

We have found, too, that our advertisements are shown to good advantage and, judging by results, have a wide appeal. In addition, it must also be placed on record that our new products, factory expansion or increased production, are invariably featured editorially so that distributors are kept well informed as to Lec's progress.

When this magazine first came into being at the turn of the century there must have been many who prophesied a short existence. After all, it is only within the last decade or so that the refrigerator is coming into its own as far as this country is concerned. Yet, as year followed year, its circulation maintained a well-merited rise due to the dogged persistence of those engaged in its presentation and their unfaltering confidence that, given time, refrigeration would become as much part and parcel of our way of life as the radio or motor-car.

These same beliefs brought Lec into being at the end of the last war. At our present rate of progress we shall be a mammoth organization by

the time we celebrate our own diamond jubilee, and homes without refrigerators will be the exception rather than the rule as at present.

That day is some 46 years from

now but I have no doubt whatever the pages of MODERN REFRIGERATION containing Lec's "sixty glorious years" will be as cleanly and well produced as to-day.

There will be a difference, of course. With refrigerators as commonplace as TV sets the circulation will at least have trebled and publication will probably have to be weekly instead of monthly.

In all sincerity, my best wishes for the future of MODERN REFRIGERATION. May our happy association long continue.

From Mr. E. G. ROWLEDGE, director and general manager, Prestcold Refrigeration Division, Pressed Steel Co. Ltd.

SIXTY years of service to the refrigeration industry, extending from the end of one century until after the middle of the next and throughout the reigns of six sovereigns, is a record of which MODERN REFRIGERATION can well be proud. During this long period the domestic refrigerator has changed from first, an ingenious novelty and subsequently, a desirable household furnishing which was nevertheless a luxury, to an article which is now recognized as an essential item in every up-to-date home. Commercial refrigeration has similarly progressed to a stage at which it is now accepted as indispensable not only to the preservation of foodstuffs, but as an

essential accessory to industry, agriculture, medicine, scientific research, and others. MODERN REFRIGERATION has recorded these developments for 60 years and in doing so has turned the news of yesterday into the history of to-day. The directors, management and staff of the Prestcold Refrigeration Division of Pressed Steel Co. Ltd. send their congratulations on past achievements and their sincere good wishes for an even more successful future.

From Mr. N. F. T. SAUNDERS, B.Sc., M.I.E.E., F.C.I.S., M.Inst.R., M.Amer.S.R.E., general manager, Coldair Ltd., responsible for the design and manufacture of all G.E.C. appliances

IN 1898 when COLD STORAGE AND ICE TRADES REVIEW first appeared there was no such thing as a household refrigerator. A few fortunate people possessed an ice box. The interesting thing is that by that date considerable advances had been made in the manufacture of ice by means of mechanical refrigeration with the result that most of the ice supplied for use in ice boxes in ordinary homes had been artificially manufactured.

In about 1910, mechanically operated refrigerators began to appear in U.S.A. but it was not until the 1920s that there began to appear any quantity in this country. These early refrigerators, as one might expect, were similar in appearance to the old-fashioned ice box. They had a compressor belt, driven by an electric motor, connected to an evaporator which was usually made of brass or copper sheet and copper tubing, and to a condenser which was made in somewhat the same way.

It was not long, however, before at least one important manufacturer in U.S.A. and in this country produced the first sealed unit. In this the compressor and motor were put together inside a sealed container. In the early days manufacturers used SO_2 as the refrigerant, but with the emergence of the new refrigerant dichlorodifluoromethane (CCl_2F_2) the number of people making sealed units increased.

Associated with the development of the sealed unit was the use of a capillary tube to maintain the pressure difference instead of a valve. The capillary tube is not only a more simple and trouble-free device, but avoids the necessity for an unloading valve since it automatically allows the pressures to equalise when the thermostat has cut the motor off. Thus, the motor starts again against no pressure difference.

Many types of evaporator were developed, but until recently the most satisfactory was probably the one made from stainless steel. This was very good indeed, but involved expensive tooling and heavy presses and welding apparatus. The latest idea in evaporators for household refrigerators is the roll bond aluminium evaporator. In this a pattern of tubes is printed on one sheet of aluminium, and this is then covered with a second sheet. The two sheets are passed together through a heavy rolling operation, and they become permanently attached to each other except where the printing is. The combined sheet is then placed between two heavy platens and blown up. Thus, the tubes appear within the sheet.

The first important development in refrigerator cabinets was the forming of the front edge of the cabinet in the steel of the outer casing itself in such a way as to give the cabinet adequate strength without any internal additional bracing, thus eliminating the wooden frame and achieving a much more pleasing appearance.

Of recent years other improvements are the use of a finish described as plastic-on-steel for the interior or the forming of the whole interior out of a sheet of plastic.

Inner door panels are made from

a sheet of thermoplastic material, heated and vacuum formed to a very intricate shape.

For a period, various arrangements for the automatic defrosting of household refrigerators were used, but the tendency now is for these to disappear. The latest idea, which seems to be the most satisfactory, is to employ a system having two circuits. In one the evaporator is insulated on the outside so that the ambient air cannot touch it, while in the other the evaporator is held at a temperature slightly above freezing point. In such an arrangement the necessity for defrosting is practically eliminated.

By this time the satisfactory technical operation of a household refrigerator is completely taken for granted. Indeed, every manufacturer offers a genuine five years guarantee on the mechanism which is something no householder can obtain on any other article he is likely to buy. Manufacturers, therefore, tend to concentrate on making their products more attractive in appearance, and more useful in service. On the appearance side, manufacturers are giving a great deal of attention to both form and colour, thus ensuring that the refrigerator will go into the kitchen in harmony with other items of equipment. On the operational side, manufacturers have kept in touch with the developments of refrigeration in the preservation of food generally with the result that the household refrigerator usually now incorporates reasonable means for the storage of packets of frozen food.

The result of all this development is that, while the refrigerator of 1958 is an incomparably better article than that of the 1930s, its list price is only about 50 per cent. higher.

From Mr. R. SAUNDERS, chairman and managing director, W. A. Taylor, Ltd.

THE diamond jubilee of MODERN REFRIGERATION is a singularly appropriate occasion on which to remind us all of an astonishing progress in scientific and industrial applications in the world of refrigeration.

For the writer's part, the last 32 years have constituted a fascinating study, and, to have been intimately concerned, is to have witnessed a revolution by which refrigeration broke out of the bounds of centralized commerce, into the everyday life of the whole of mankind.

In the course of my travels, I have watched natives, who until quite recently, had only heard of the snows which capped distant mountains, by way of legend and mythology, handling ice and frozen foods in as blase a manner as any Thames-side worker.

In such a short time, not only has the staple diet of Europeans become more varied and attractive, but hygiene has become the practice of habit, and the mortality of peoples due to food poisoning, which was high at the end of the 19th century, is now an incident warranting a column in the national newspapers ; and all this primarily due to the advance of the science and practice of refrigeration.

Like most other great advances, refrigeration received its initial impetus from the great pressure of rising populations, and the increasing development of new lands, and we remember with gratitude the great pioneers, who fought so hard to establish their ideas and ideals in the face of very great discouragement.

The writer is primarily concerned with insulation, and takes pride in such a close connection with refrigeration. Insulation has advanced to meet great demands in hygiene, and construction has developed into a science demanding very considerable skills, a full knowledge of the master science, and the provision of equipment and organizations of an involved and high order.

This diamond jubilee is a milestone from which we can look back on very commendable progress, but in looking to the future, we should realize that there is much to be done in the less developed parts of the world, in which refrigeration will play a major part.

Practically the whole of heavy industry now relies upon refrigeration to supply it with control apparatus and simulation gear, and most consumables, whether edible or otherwise, pass at one stage or another in the course of manufacture, through zones of controlled temperature provided in many instances by the refrigeration industry.

The writer has watched the construction of commercial refrigeration develop from crude wooden boxes, into hygienic stainless steel and chromium, enveloping temperatures provided by intricate but highly reliable equipment.

Two wars undoubtedly provided considerable impetus to development, and the electrical industry shares, in some degree, the credit for the great advance in the reliability factor of automatic controls, without which much of the advance in pure refrigeration would have been impossible. On the other hand, refrigeration has provided some of the means by which these minute and intricate controls are manufactured and assembled.

In remembering, therefore, the great pioneers, we should also, in this generation, take pride in our own achievements, and hope that there will be sufficient incentive within the industry to maintain the same rate of progress in the future.

This is of necessity some thinking aloud on the part of one who is on the inside looking out, and one cannot help feeling that we are members of a society which has been very privileged, in that its endeavours have resulted in so much human progress.

The writer was fortunate to become associated with the industry at the time when modern health regulations were being revised and were forced upon food distributors and processors who had long been luke-

warm in their approach to refrigeration, not recognizing perhaps that it would, within so short a time, completely revolutionize their industry and add greatly to its prosperity. Medical science was beginning to realize that further progress would depend upon greater degrees of control, and it soon became apparent that refrigeration would supply this need.

We are told that the day of the butcher's shop, with hanging meat exposed to dust and flies, are numbered, and it seems clear that the health authorities, without aiming at the dissolution of any industry or trade in particular, are determined to stamp out this farcical state of affairs, where bacteria are allowed to multiply on edible goods which are part time under rigid control, and part time in the same conditions as a century ago. Surely this is the crossroads, and the era of hygienically pre-packaged and frozen food, in all varieties, will provide a great opportunity for an industry that seems at present to have reached at least one of its goals.

Insulation is playing an important part in the development of low temperatures for processing and storage, and there is great activity in many fields of industry, to produce a home-made synthesis which will take the place of imported material used hitherto. These are very commendable efforts, and we look forward to the time when really stable materials of a sufficiently robust make-up are available to meet the needs of the industry. Progress in this field has been slow, because of some apparent lack of the appreciation of cardinal principles on the part of manufacturers who would appear to lack practical experience.

The great chemical industries are taking an active part in this rush to jump on the band wagon of refrigeration, but they would be well advised to make a more careful study of the requirements of the industry in a practical sense, and to give greater consideration to the theory of the matter.

Advance is only possible by reason of detailed organization and great preparation, so that selling power will waste itself upon emptiness unless some technical education is available for those engaged in sales. It is certain that the industry will welcome any assistance which provides it with the means of advancing the application of refrigeration to human welfare and scientific progress, and resistance to new products must not be taken as the reaction of vested interests, because this is not by any means the case, as is quite clearly seen in the major cork interests turning their attention to synthetics in a limited degree.

The new era will clearly make great demands upon systems of transportation for perishables, and it is becoming increasingly obvious that the eye and palate appeal of frozen food depends in a major degree upon its handling, and this includes road and rail transport. There appears to be much fallacious thinking on this subject, and an overhaul of techniques is much overdue.

The day of the perambulating cold store is almost upon us, and recent advances in the design of diesel power units and gears, combined with alterations in traffic regulations, would seem to have cleared the field of much of the obstructions which hitherto compelled attention upon pay load at the expense of control.

MODERN REFRIGERATION is to be congratulated upon the constancy with which it has reported and commented upon progress in the past, and the future provides equal opportunities in an era of development which can do even greater things for humanity.

From Mr. J. C. TAYLOR, managing director, U.D. Engineering Co. Ltd.

WITH this issue MODERN REFRIGERATION celebrates its diamond jubilee, representing 60 years of continuous publication since its establishment in 1898 as *Cold Storage and Ice Trades Review*. This is a remarkable achievement by any standard and, in offering my sincere congratulations to MODERN REFRIGERATION, its editor and all who are associated with him, I am sure they would wish me at the same time to spare a moment to remember those who are no longer with us but who, in carrying the heat and burden of the day, contributed so much to the success which the journal now enjoys.

During the years spanned by the life of the journal tremendous progress has been made in the art and science of refrigeration, for what was formerly an art has now become truly a science. The late Hal Williams once said that refrigeration

was the hand-maiden of industry and, if this then was a measure of its application and usefulness, we have only to consider the position to-day to obtain a further measure of the industry's achievement; for, if refrigeration is still a hand-maiden, it now occupies that position not only in regard to industry but to all, including the household and, moreover, provides controlled temperatures for and from the highest to the lowest degree.

It is not only in the field of application or in the range of temperatures which the industry can now provide that progress can be measured. In the early years of the present century refrigerator compressors were slow-moving machines and, with their prime movers, occupied considerable floor space. Moreover, with their associate equipment and methods of operation, they were relatively inefficient. Since that time we have seen the development of what was popularly called the high-speed compressor which, in its turn, is being supplemented by multi-cylinder compressors running at speeds of upwards of 1,000 revolutions per minute and for very large jobs, and notably in the field of air-conditioning, the elimination altogether of the piston machine and the substitution for it of the centri-

fugal-type compressor employing speeds of the order usually associated with this type of machine. Hermetically-sealed compressors are now established and we have yet to learn how far their range of application can be extended.

Limitation of space permits only a passing reference to the progress which has been made in the design, manufacture and application of the main auxiliaries in refrigerating plant and, similarly, with automatic devices for control of refrigerant flow and of the numerous other operations associated with the use of refrigeration equipment, whether large or small. These developments combined with the wide range of refrigerants available to-day, improved insulation technology and materials, ensure installations of refrigeration equipment capable of operating at the highest efficiency and low cost.

The industry and the men serving it have reason to be proud of the progress that has been achieved and which has for its background the general advance in science and technology, with all that that implies, not the least in education. Even here the industry has taken thought for the future in the part that it played in the establishment at the Borough Polytechnic some 10 years ago of the National College in refrigerating engineering.

Behind this story of human endeavour and progress lies the dissemination of knowledge and experience in which the journal, whose diamond jubilee it is, has contributed so much. To our congratulations let us add our thanks for services provided and the wish that MODERN REFRIGERATION will enjoy in the future the success of the past 60 years.

From Mr. H. C. TIMEWELL, general manager, appliance division, English Electric Co. Ltd.

I FEEL very flattered that I should be asked to contribute a few remarks for the diamond jubilee of MODERN REFRIGERATION because it was some 28 years ago that I met for the first time that great figure, Mr. Joseph Raymond, the late father of our editor. His tremendous enthusiasm for everything to do with refrigeration was infectious and he was relentless in pursuing his ideals and hopes for this great industry through the pages of MODERN REFRIGERATION. In those far-off days, mechanical refrigerators for domestic purposes were considered a rare luxury, but due to the unre-

mitting energy of those pioneer manufacturers, assisted by MODERN REFRIGERATION propaganda, within a few years the domestic refrigerator had established itself in many thousands of homes, mostly in those of the upper income bracket, although refrigerator makers were always acutely aware that real success could only be achieved in the mass market. During the 10 years before the outbreak of war, most owners of modern flat property installed refrigerators as one of the major inducements. In fact, by 1939 one could say that practically every flat of recent construction and many with quite moderate rentals were equipped with refrigerators.

In retrospect, one of the most significant aspects of our industry is the highly concentrated attack that was made on the domestic market. It is not an exaggeration to state that no major appliance for the home has been the subject of such large advertising expenditure and intensive promotional efforts as the household refrigerator. While it is disappointing that the market growth has lagged behind other more recent domestic equipment, this has not been due to lack of drive and ingenuity but for only too familiar extraneous reasons.

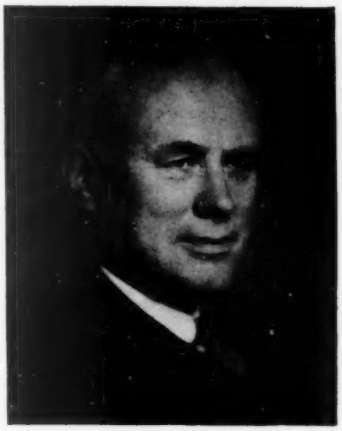
In the domestic refrigeration section of the great refrigerator industry, it looks as though we have now reached the turning point when at last the " break through " is in sight. It would be very befitting if we, in this 60th year of MODERN REFRIGERATION, could regard 1958 as the turning point in our history. To the very able son and inheritor of the outstanding traditions of its founder may we wish even greater success to MODERN REFRIGERATION as it forges forward to its centennial celebration.

From Sir HENRY S. TURNER, London manager, N.Z. Refrigerating Co. Ltd.

ALTHOUGH Government policy, during the past 15 years, to secure an increase in the proportion of home-produced meat in the weekly budget of the people has been very successful, most of us would still think ourselves badly fed if we could not supplement our menu with a large proportion of imported meat.

Leaving aside canned meats, bacon and poultry, we ate, before the war, nearly as much imported meat as home-produced ; to-day I suppose we eat about 3 lb. of imported meat for every 5 lb. of home-produced and there is no doubt that we should be very badly fed without the help of refrigeration which brings us all that extra meat.

Looking at it from the other end of the telescope, " down under," I



suppose New Zealand depends on refrigeration for a greater proportion of her national income than any other country in the world.

Refrigeration begins to play its part at the works in New Zealand, where the best lambs in the world are prepared for export—continues on the refrigerated ships that specialize in the ocean carriage of meat and so through to refrigerated stores in the United Kingdom to the butcher's shop—it is refrigeration all the way, successfully delivering, in perfect condition, to the people in this country the best products of New Zealand.

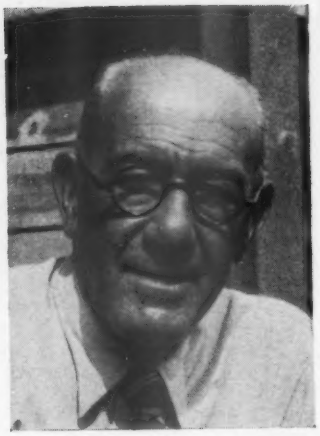
All honour to the pioneers who opened up these possibilities in 1881 ; all honour to those who followed to improve and develop the technique and practice and all honour to those who to-day are still ready and anxious to find even better ways of applying the principles of refrigeration for the better feeding of us all. From the point of view of New Zealand one of the most successful developments recently has been the result of the partnership between the packer and the refrigeration expert in the presentation of lambs' livers and kidneys and other valuable edible by-products of the meat export industry.

Having been associated for nearly 40 years with the New Zealand meat trade the writer feels an unusually strong interest in paying tribute to the enterprise represented by the foundation 60 years ago of MODERN REFRIGERATION, a publication which still leads in its own field.

From Mr. L. J. WOLF, managing director, Refrigerator Components Ltd.

One cannot let the 60th anniversary of the founding of MODERN REFRIGERATION go by without offering all personnel connected with it heartiest congratulations.

You and the paper have been of tremendous help to the industry and it is my hope that it will enjoy continued prosperity and the support of all concerned.



Refrigeration Milestones

The British Perspective

1755 Evaporative cooling at reduced pressure Cullen
1757 Latent heat discovered ... ... Black
1774 Vapour absorption by liquid observed Priestley
1798 Mechanical equivalence of heat. Theory and experiments in essays by ... ... Rumford
1810 Absorber added to Cullen's machine ... Leslie
1822 *et seq.* Various gases liquefied ... ... Faraday
1834 First continuous cycle compression machine Perkins
1835 Carbon dioxide solidified ... ... Kemp
1843 Accurate measurement of mechanical equivalent of heat ... ... Joule
1857 Harrison refrigerating machines made in England Siebe
1860 Refrigerating plant at :—
Brewery of Truman Hanbury
Chemical works of Young Meldrum
Harrison-Siebe
1861 First meat-freezing works, Sydney ... ... Mort
1862 Ether ice-making machine at London International Exhibition, Crystal Palace ... Harrison-Siebe
1862 *et seq.* Absorption machines of Carré design made by
Pontifex & Wood
Ransomes & Rapier
Reece & Stanley
Tyler & Ellis
1868 Mobile refrigeration for military field hospitals Siebe-West
1873–1881. Cold-air machines ... Bell-Coleman
Giffard (J. & E. Hall)
Haslam
Lightfoot
1873 Grand Primio at Vienna International Exhibition awarded to Harrison refrigerating machine exhibited by ... ... Siebe-West (also 1878 at Brussels)
1876 Ammonia compression machine ... ... Linde
1876 Attempts to ship frozen meat ... ... s.s. *Norfolk*
s.s. *Northern*
1879–1880 Frozen meat Australia to England
s.s. *Strathleven*
1886 I.Mech.E. Paper on Refrigerating Machines Lightfoot
1887 Gear-driven, long-stroke compressor Kilbourn
1888 CO_2 Refrigeration ... ... Hall
Direct expansion beer cooler ... ... Sterne
Atmospheric condensers
Gilled pipe air coolers
Shell and tube brine coolers
1889 Totally enclosed compressors with rotary gland Hall
Kilbourn
West
1890s SO_2 refrigeration ... ... Douglas
1898 Lloyd's Register of Shipping issue first refrigeration rules
1898 MODERN REFRIGERATION founded as *Cold Storage and Ice Trades Review*
1899 Institute of Refrigeration founded as B.C.S.I.A.
1900 Quick chilling of beer West-Rogerson-Chew
1912 Attemperated brine circulation ... Woods
1912 Sleeve valve compressor ... ... Prestage
1918 *et seq.* Quick revolution multi-cylinder enclosed compressors
Shell and tube condensers and evaporators
1922 Liquid pre-cooling by primary evaporation ... Brier
1924 International Congress of Refrigeration in London
1926 *et seq.* Automatic electric refrigeration in commercial and domestic ranges ... ... Ellarcold
Frigidaire
Kelvinator, etc.
Centrifugal and rotary compressors
1926 Supercharged sleeve valve compressors

Solid CO_2 manufactured by compression and partial evaporation
Semi-automatic industrial refrigeration
Absorption domestic refrigerators ... Electrolux
Ice Stove
Thermofrigor

1931 Dichlorodifluoromethane refrigerant introduced
1931 Low-temperature absorption machine developed for CO_2 liquefaction by cold ... ... Maiuri
1934 Refrigeration Exhibition at Science Museum
1948 National College of Heating, Ventilating and Fan Engineering founded in London.

Progress in the Design and Manufacture of Refrigerating Plant in Great Britain

By BERNARD C. OLDHAM
M.I.MECH.E., M.INST.R.

IN 1898 as in 1958, design and manufacture were dependent not only on the current understanding of the problems and the requirements of the user, but on the manufacturing methods of the firms who for a variety of reasons had interested themselves in a particular range of products.

In the case of refrigeration, the needs in Britain were to ensure the transport in good condition of the abundant foods of the newer countries to distribution points in the old, also as a handmaid in the brewing and other fermentation and chemical industries.

It was natural therefore to build reversed heat engines bearing close resemblance to the prime movers of that time often on the same crank or in tandem. The known basic methods, then as now, were the cyclic evaporation and condensation of a volatile fluid and alternatively the compression and expansion of a ubiquitous substance such as air.

The volatile fluids most readily available and usable as refrigerants were ammonia whose pressures when working as such were within the range of those of the steam engines that were to drive them, and CO_2 the product of fermentation whose pressures were similar to those of hydraulic machinery. For the air expansion method suitable pressures bore close relation to those of steam engines or air compressors. Another volatile fluid, ether, was in vogue for about 40 years ; particular interest in it lay largely in its low pressure producing no container problem and rotary designs of chemical pump were readily adaptable to handle it. Manufacture of ether refrigerating plant was drawing to a close in 1898.

Sulphur dioxide was used in ammonia type plant with lower pressures and capacities from the 1890s to the 1920s.

Refrigerating machines at the birth of this journal were thus almost a duplicate of the engines driving them ; usually of the open motion work type with crosshead, vertical in small sizes, horizontal in large. In those days, particularly when on a common crankshaft, the term " compressor " was used in its narrower sense to designate the components above or beyond the crosshead, *i.e.* the piston and cylinder ; end covers, one with suction and discharge valves, of the poppet type, the other with gland only if single acting, or valves in addition if double acting ; also the stop valves and pressure gauges. The frame with crankshaft connecting rod and crosshead could be identical irrespective of whether ammonia or CO_2 compressor were ultimately fitted, and each size of frame could accommodate a number of sizes of compressors. Air compressors for ordinary compressed air duty could be mounted as alternative.

Many of the vertical machines were mounted on machined facings on side of cast iron or steel open top tanks which housed a submerged condenser, one coil or a nest of spiral wound coils being immersed in the condenser water. The low coefficient of heat transfer with the almost imperceptible water velocity meant relatively large surfaces.

If vertical, the frame was often A-shaped above the crankshaft, the crosshead joining or forming the crossbar of this letter and the cylinder being mounted at the tip with the gland in the space between.

These were independent of the condenser, which in land installations could be remote and of a more efficient type such as the atmospheric, which had several variants. The principle of evaporation from a water film in moving air enabled the condenser surfaces to be reduced to a fraction of those of the submerged type. The use of natural draught, however, limited choice of location and often led to high installation costs and long connecting pipes.

In those days the types of evaporators employed were few due to the widespread use of ice in the distribution of refrigeration. Direct expansion or brine coils were used on the walls and ceilings of cold stores, except in the case of open air cycle where no " evaporator " was needed. In land installations the bunkering of coils in strategic positions to economise natural air circulation was coming into vogue.

Brine cooling evaporators in small sizes were of the bulky submerged coil in tank type alongside and often built in with the condenser. In ice tanks the same principle was employed often with reduction in coil size by bunkering and brine circulation.

Insulation materials were selected largely according to availability, the main consideration being the splitting up of cavities into myriads of minute air spaces to inhibit air movement. Liberal use of double tongue and grooved boards, water-proof paper between, provided the main attempt to hinder moisture penetration.

The third decade of this century and a similar period of this journal's history saw the transition in design of reciprocating machinery from ponderous open frame slow rotative speed to compact enclosed crankcase with higher rotative speed ; the development of oils with low congealing temperature facilitated this. The piston speeds were often little changed ; for example if a machine of 60 in. stroke were replaced by one of 10 in. stroke, an increase in rotative speed from 60 r.p.m. to 360 r.p.m. involved no change in mean piston speed. Similarly the gas speeds through the valves might be of the same order as previously but the orderly opening and closing of valves without bouncing or mechanical actuation required a design different from the low frequency older type.

The need for evacuating the cylinder as much as possible at the end of the discharge stroke forbids the creation of pockets in which the compressor refrigerant can collect and much design effort was expended in valve design. Availability of materials and manufacturing methods which would give reliable service limited development, *e.g.* a multiplicity of small valves serving each cylinder in large compressors preceded a minimum of larger concentric valves performing the same function.

The quickening of design pace and manufacturing methods with the 1914 war, the development of light industries in the 1920s and the appeal to the mechanical instinct of the individual by the coming into general use of the automobile led to a revolution of design throughout the whole range of industrial, commercial and household applications.

By the end of the 1920s every manufacturer of industrial refrigeration had designed or acquired designs of enclosed crankcase quick revolution compressors, with shell and tube or multitubular condensers and evaporators, and a multitude of methods for the distribution of refrigeration and electric drive with direct coupling or V-belt drive had become the rule.

Automatically operated refrigerating machines with light-weight preassembled condensing units and compact and precharged air cooling evaporators were introduced to cater for the commercial field ; using methyl chloride they could be installed with easily run connecting piping, and set to work in as few hours as the days formerly taken.

The mechanical refrigerator quickly superseded the ice box and the new market thus formed enabled mass production methods to be introduced, and extended into the domestic field. The development of refrigeration cabinets and display cases received an impetus with the development of furniture steel and steel pressing methods, and later there has been selective use of plastics both for linings, fittings and insulating materials. Bulkiness of refrigerants such as methyl chloride and SO_2 became a virtue to enable enclosed compressors to be multicylinder to permit constant crankcase volume and thus avoid oil pumping. In fact SO_2 became widely adopted for domestic refrigeration in about the same year as it was discontinued for industrial refrigeration.

The quest for new refrigerants to suit automatic control of refrigeration led in 1931 to the introduction of dichlorodifluoromethane ("F-12" or "Arcton-6 ") and several related fluids which have facilitated the entry of automatic non-attended or semi-automatic attended plants into practically every field of refrigeration. Unfortunately for the customer and good for the business of the chemical manufacturer the latter does not supply refrigerants to a specification that they shall incorporate their own barrier cream. A very few years of war saw the introduction of petrol containers which could be riddled with shot without losing their precious contents. Yet after a quarter of a century of the modern so-called safety refrigerants the continued functioning of all but mass-produced quality-controlled refrigerating plant appears to rely on the human element, the watchdog who is told to sniff every few days at a near-infinity of miles of joints at near-zero miles per hour with the aid of a temperamental flame. Cannot the machine manufacturer insist on a specification that the chemical manufacturer provides refrigerants with leak-inhibiting properties ?

The cyclic evaporation and condensation of a volatile fluid as a method of refrigeration is, of course, not confined to compressor refrigeration. The absorption system in which an absorber generator performs the functions of the suction and compression stroke of a compressor has been in use throughout this century, but its makers have changed and have remained strictly limited in number. A highly successful domestic design commenced manufacture in 1926, and in 1931 the absorption system was revived for industrial use in the liquefaction of CO_2 by low temperature instead of by pressure.

Megatons rather than mere hundreds of tons of refrigeration can be dealt with in single absorption units. The lack of engineering personnel with an understanding of and interest in thermal actuation in this age of mechanical and atomic thought appears to confine interest in the orderly control of disorderly molecules by thermal means to those who regard waste heat as a virtue rather than a nuisance. Vacuum refrigeration has its own field in a subdivision of air-conditioning where copious steam is available ; hand-operated vacuum pumps with sulphurous acid absorption still serve for carafe cooling at the back of beyond, where the dumb-bell type of absorption refrigerator fired by any available fuel also cools cabinets.

Air compression and re-expansion as a means of refrigeration was revived in the 1940s on lines similar to the 1898 type and a new high speed has more recently been developed for aircraft cooling under conditions where the safest of so-called safety refrigerants would constitute a hazard.

The incentive for refrigerating engineers to cater for all outlets for refrigeration has been reduced, partly by diversity of the problem and partly by paucity of manufacturers of industrial refrigeration. Few in number as the latter always were, they have become fewer and more productivity conscious with an appalling lack of provision for high evaporating temperatures. Instead of being able as formerly to use a minimum size of compressor with auxiliary suction ports and evaporators for dealing with increased load at higher evaporating temperatures in a self-acting manner, auxiliary ports are provided to reject at the bidding of capacity control gadgets a portion of each suction charge ; " V " or " W " arrangement of compressors now popular are admittedly too compact for additional suction lines.

The ubiquitous use of dry compression has been confirmed by the transition from non-automatic attended to semi- or fully-automatic plants. Productivity has demanded the use of mass or batch produced machines ; a standard machine is adapted to a non-standard duty or preference by the addition of a multiplicity of gadgets, some valuable, others expedients, to avoid basic design change. This practice may be a necessity with houses or automobiles, but is it so essential in industrial or commercial refrigeration ? Why, for example, is a duty involving a pressure ratio of, say, 2 catered for in the same machine as a pressure ratio of 5 or 6 and a single minimum suction pressure rather than a multiple maximum ?

There are welcome signs of developments in cases where the duty is big enough or small enough, for example, by the

use of centrifugal compressors now coming more into favour after decades of limited use ; the time cycle of evolution and revolution in design, however, indicates that the need for revolution in design is at hand. The need for reducing the ratio of the cost of a B.t.u. of cold to approach that of a B.t.u. of heat is as great as ever ; the potential means should be fully recognised and developed. The stillborn cold multiplier of a quarter century ago is presumably no longer a prisoner of patents, and the position as to low efficiency with the Peltier effect may yet be reversed.

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60 Years of Refrigeration Progress in Australia

By F. L. GOODMAN

past-president, Australian Institute of Refrigeration, president, Victorian Division of A.I.R.

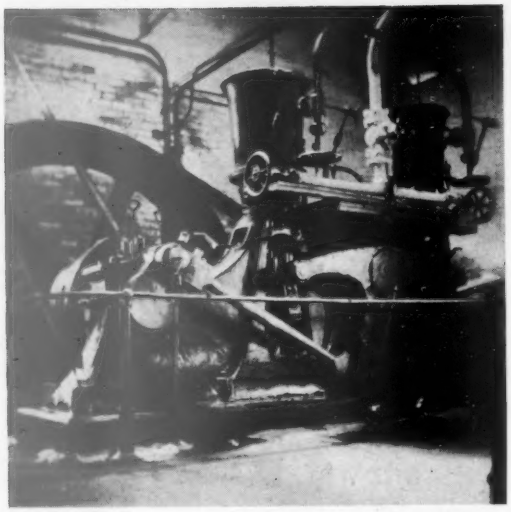
ON the occasion of the diamond jubilee of MODERN REFRIGERATION, the writer is gratified to have the honour of participating in the issue commemorating this fact although only being able to claim a mere 39 years' association with this journal. It has, however, been pleasing to note and follow the good work done for the refrigeration industry in general by the late Joseph Raymond, and followed on by his son. Sixty years from the inauguration of the original *Cold Storage and Ice Trades Review*, later succeeded by MODERN REFRIGERATION, covers a lifetime of giving to their readers first-hand knowledge of refrigerating equipment and operation progress, which has been invaluable to those situated all over the world. We sincerely trust that the future will provide the progress desired by those responsible for this publication.

Australia has moved ahead and kept abreast of the times since James Harrison designed, and had manufactured in England, the first refrigerating compressor (using a refrigerant) and complete with the first ice-making plant 101 years ago in July next. At the time of the inauguration of the journal, there were many horizontal, double-acting and vertical, single-acting, ammonia compressors in operation in Australia ; some were manufactured here, but others were imported from England and the U.S.A. and it is interesting to note that there are still some of these compressors in operation to-day. Later, there arrived from England the " medium speed " horizontal, double -acting compressor with multi-valve arrangement and an r.p.m. of 220 as compared with the old 60 to 80 r.p.m. all doing remarkably good refrigeration work and built to last a century.

Progress must move ahead, so that in 1919, Australia commenced to manufacture the enclosed type, single-acting, vertical ammonia compressors and, in a very short time, all the manufacturers transferred their affection to this type on account of the demand, because it was cheaper and occupied less valuable space. We must admit that both the United Kingdom and U.S.A. were ahead of Australia in the manufacture and operation of this type of ammonia compressor and again in 1923, when Australia imported refrigerating plants using sulphur dioxide and methyl chloride as refrigerants from the forementioned countries, for domestic and small industrial users, but it was not for long, for a firm in New South Wales and South Australia commenced to manufacture this type of plant. Later the " Freon " plants came into the picture, and to-day there are manufacturers in practically every State and production exceeds demand for the time being. Naturally, the demand for domestic refrigerators has relegated the ice manufacturing position inaugurated by James Harrison in 1856 to a relatively minor position in the refrigerating industry in Australia to-day.

To-day, we are again following overseas practice with the " multicylinder," high speed compressors with capacity control, and it is evident that both the United Kingdom and the U.S.A. are taking a prominent part in this change, but, it must be admitted that some manufacturers in Australia have been making four and six cylinder V-type compressors for four or five years, probably more with four cylinders. Undoubtedly, it will take some time to convert some of the older refrigerating engineers away from the slower r.p.m. two cylinder compressors ; time and the experience of others create courage for experimenting.

Refrigerating condensers over the period have not changed much ; there are still atmospheric condensers of various types of coil in but very few of shell and tube vertical or horizontal types. These appear to have just faded away, but the evaporative type of condenser is definitely displacing the older types on account of its space saving and inherent advantage operating under the humid conditions that prevail in various parts of Australia. Not only with ammonia plants is this the case, but to a large extent where air-cooled condensers are not satisfactory under such conditions for " low pressure " refrigerating plants. Australian manufacturers have carried out a deal of research



A real old-timer—a McDonald beam type Hercules in Tasmania.

and experimentation with the evaporative type in the required coil surface area, c.f.m. or air movement, and other improvements.

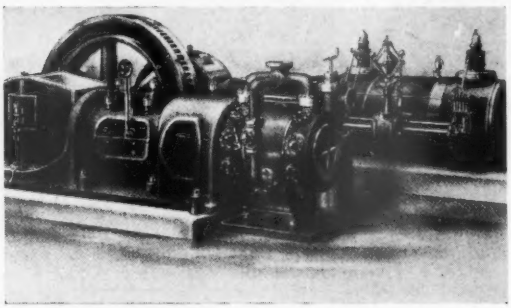
The direct-expansion and flooded wall and ceiling coil evaporators will still be utilised for cooling and freezing work where loss of weight in the perishable product being cooled means the difference between profit and loss ; in other words, it is not what one saves that counts, it is what is lost into atmosphere and finally goes down the drain-pipe. However, forced draught cooling, chilling and freezing units, either thermostatic expansion or flooded, have

A mixture of enclosed and horizontal compressors in South Australia.

received considerable attention by Australian manufacturers and have now reached the stage where they are now being applied to a very large number of chilling and freezing operations. As a matter of fact, there are many of these units operating in temperature zones as low as minus 60° F. and minus 20/30° F. is general practice for quick-freezing of berries and vegetables.

Sodium and calcium chloride brines have, in the past 10 years, been almost superseded by chilled water (known as sweet water) in dairy product factories, usually by the ice build-up on coils principle. As the desired temperatures of milk and cream range from 38° to 45° F. this system of cooling through plate heat exchangers has proved to be very efficient.

Air-conditioning in Australia since the last war has progressed in an extraordinary manner in many ways, not only for comfort cooling in office buildings, both Governmental and civilian, but in processing factories all over Australia. Particularly is this so in large office buildings, for the powers-that-be have seen fit to lift the restrictions on the previous height of such, and there are many of these constructed or in the course of construction that are in the vicinity of 260 ft. high where formerly the height was restricted to from 110 ft. to 130 ft., and in practically every State these new buildings are being fully air-conditioned. This has been brought about by the new trends in design of equipment and modernized operation,



Wildridge & Sinclair machine installed in Australian dairy.

showing a saving in capital and operating cost, naturally an increasing demand which is very satisfying to the industry. Only late last year, an Australian company completed a large air-conditioning contract for the Government of India, which comprised a large number of small-to-large " packaged units " for Indian radio stations. Now that television stations are progressing in Australia and air-conditioning is definitely required, another large avenue for this industry has opened.

The trend towards the use of refrigeration in Australia is becoming greater every year, not only amongst those users who are compelled to use it in their manufacturing processes to keep abreast of the increasing population demand, but almost periodically there are others who discover that with its aid processing is improved, or those who seek advice on how it can be applied to production. So, Australia is not standing still in refrigeration progress.

Modern Refrigeration is obtainable from the manager, Maclaren House, 131, Great Suffolk Street, London, S.E.1, at thirty-five shillings per annum, post free to any part of the world.

PROGRESS OF REFRIGERATION IN GERMANY

60

By Dr. H. L. von CUBE*

Refrigeration Theory

THE scientific basis of refrigeration lies in thermodynamics of which the principal laws were discovered in the second half of the previous century.

J. R. Meyer expounded in 1842 the equivalence of heat and work. H. von Helmholz described in 1847 the law of the conservation of energy. R. Clausius found in 1850 the connexion between first and second laws of the theory of heat and from that evolved the possibility of generating cold. This led in 1865 to the important conception of entropy in the theory of heat. Nernst in 1906 formulated the third principle law of the inaccessibility of the absolute zero.

The first book dealing with refrigerating problems was written by G. Zeuner in 1859. Even at that date he gave vapour tables for refrigeration which were extended and brought into the well-known form by R. Mollier in 1895.

The Zeitschrift f.d.g. Kaelte-Industrie fostered the extension of refrigeration knowledge through H. Lorenz who in 1894 expounded the first refrigeration cycle, but about 1868 C. v. Linde had become Professor of the Technical High School at Munich and about 1870 his work on the heat reduction to lower temperatures by mechanical means became the beginning of scientific refrigeration. Scientific research and technical development thereafter progressed hand in hand.

The thermodynamics of binary mixtures were expounded by R. Plank in 1909 as a scientific basis of absorption refrigeration machines; in 1913 Altenkirch calculated the multi-stage absorption machine. The well-known diagrams by Merkel for ammonia water mixtures appeared early in 1928.

The first refrigeration research institute in Germany was established with the help of industry in 1888 in Munich. The measurement of refrigeration capacity was an important study. Around these questions the German Refrigeration Association (D.K.V.) was founded in 1909 when the rules were prepared. The founding of the Refrigeration Institute of the Technical High School in Karlsruhe with Professor Plank in the year 1925 was an important step in research and theory; through its work refrigeration production and application were extended and after the war the Federal Research Institute for Food Conservation was established. In later years K. Nesselmann laid the foundation stone of a new building in which the Refrigeration and the Thermodynamic Institutes will be combined.

Technical Development

The first refrigerating machines in Germany were cold-air machines by F. Windhausen (1870) and Behrend (1867). A decisive step for the development was the famous discussion between Windhausen and C. v. Linde in 1873 at the Vienna Brewery Congress, in which Linde advocated the vapour compression machine so convincingly that the leading brewers became interested in it and in 1877 the first brewery refrigerating installation was achieved with Linde in Munich. The choice of ammonia as the refrigerant for working with lubricating oil and the inevitable water, and the well-designed construction with positive valves, small clearance space and good retention brought success to the refrigerating machine and to Linde's patents.

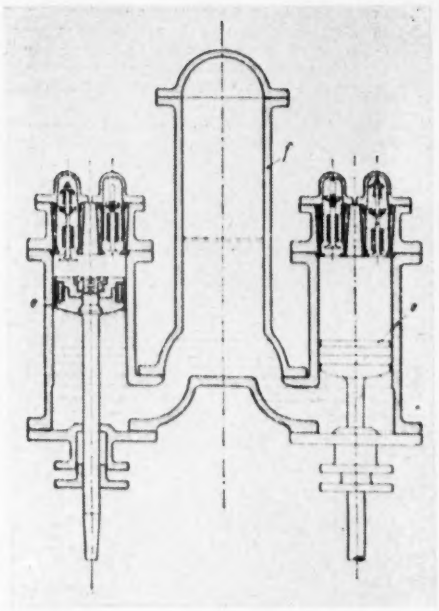


Fig. 1.

The first vertical ammonia machine (fig. 1) worked for 30 years. The first horizontal compressor of the well-known arrangement which lasted until 1930 was built in 1877 and was a monument to the art of that decade.

Right up to 1929 the horizontal slow-running ammonia compressor held the field. Transition to dry compression took place (Koeniger (1915) for SO_2, Fischer (1920) for NH_3). The compressor with enclosed crankcase, which was originally built by Osenbruck in 1880, was developed around 1930 as multicylinder, quick running, and uniflow and was built by Freundlich and Ahlborn. The quick-running reverse flow compressor with V and W arrangement of cylinders was introduced in Germany in recent years by Borsig and Ideal Standard.

The first turbo compressor for refrigeration was built by Jaeger in Leipzig in 1923 (in conjunction with the American firm Carrier). Brown Boveri & Co. installed in 1925 a NH_3 turbo-compressor for 8,000,000 cal./hr. for glauber salts production; this was developed in 1930 into the Frigibloc, the first hermetic turbo-compressor with the driving motor built in (fig. 2). The turbo-compressor is now made also by the Linde and Borsig firms.

The first evaporators and condensers were submerged circular coils. The real development of heat transfer apparatus was guided by the researches of W. Nusselt in 1916. Linde built in 1923 the first "evaporator elements"; in 1930 evaporators with nearly vertical pipes were used. The first trickling condenser was used by Linde in 1892. Shell and tube condensers and evaporators were in use around 1930.

The first absorption machine in Germany was built in 1878 by F. Winkelhausen for sulphuric acid and water. The international Vacuum Ice-making Society took over

* *Brown, Boveri & Co.*

the production and in 1881 delivered a machine for 15 tons of ice per day. A. Osenbruck patented the resorption machine in 1895 and with Sensenbrenner developed the application of the absorption refrigerating machine. The Carré system was used in Germany about 1900 principally by the firm Vaass & Littmann, of Halle. The work of E. Altenkirch on multistage absorption machines and the so-called Kryotherm completely without moving parts was taken up by the firm of Borsig about 1925 and there principally through W. Niebergall, the systematic application of rectification was brought to a high state of technical perfection. The principle of using inert gas to make a pump superfluous discovered by H. Geppert in 1899 was developed by Platen and Munters in Sweden in 1922. Intermittent dry absorption machines for household refrigeration were in industrial production by the firm Siemens-Schuckert in 1925.

The first hermetic small refrigerating machine was the Audriffen-Singrun built in 1910 by Brown Boveri & Co. The first small refrigerating compressors were by the firms Escher Wyss and A. Teves in 1922 to 1925. After 1925 the first compressors with inbuilt motors were by Escher Wyss and Linde. The refrigerants were methyl chloride or SO_2. The first semi-hermetic compressors for NH_3 were developed around 1928 by Freundlich. The halogen refrigerants were first applied in 1936. The first motor-compressors for household refrigerators were developed in the period 1930 to 1935 ; line production of cabinets for these took place about 1930. The cabinets were of timber framing with sheet steel cladding. The transition to all-steel furniture took place after the second world war ; now plastic containers are on the upsurge.

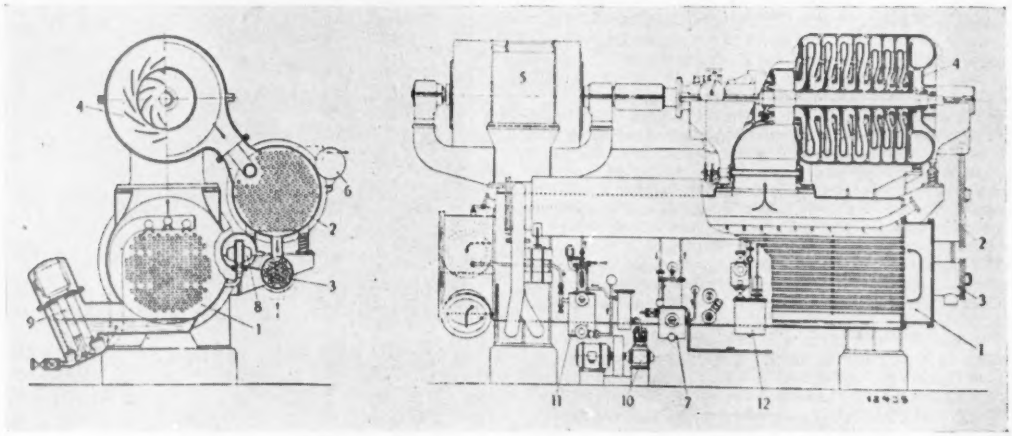


Fig. 2.

Refrigeration and A-c. Exports. — During February, 1958, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £657,093 weighing 1,096 tons, was exported from the United Kingdom. Comparable figures for February, 1957, were 1,397 tons, worth £964,953.

* * *

Exports' Analysis.—Of the 1,096 tons of air-conditioning and refrigerating plant worth £657,093 exported by Great Britain in February—quoted in the preceding paragraph—60 tons went to the Union of South Africa, 93 tons to India, 28 tons to Australia, 84 tons to New Zealand, 152 tons to Canada, 209 tons to " other Commonwealth countries," 57 tons to Eire, 9 tons to Sweden, 12 tons to Western Germany, 48 tons to the Netherlands, 84 tons to Belgium, 8 tons to France, 56 tons to Italy, and 196 tons to " other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during February, quoted in the first paragraph commercial refrigerators accounted for 154 tons, worth £87,428, industrial plant and equipment for 158 tons, worth £106,921, parts for all non-automatic power-operated machinery, including parts, for 323 tons, worth £235,821.

* * *

Exports of Small Refrigerators. — During February, 1,317 tons of complete refrigerators (domestic) (including complete mechanical units) were sent overseas from Great Britain. These exports were worth £779,287.

Reports of Progress within the Machinery and Insulation Industries

60

Great Britain

Machinery

CROWTHORN ENGINEERING CO. LTD.

With a background of machine tool building and general engineering which goes back 50 years, the Crowthorn Engineering Co. Ltd. was in an ideal position to take up in 1927 the manufacture of refrigerators. Soon it was found to be an advantage to include the manufacture of cold rooms and cabinets, and this the company has continued to do, being one of the comparatively few refrigerator manufacturers making a complete product under one roof.

In the Crowthorn tradition, it was natural that stress should be given to the production of a sound engineering product, and the Frozt-ed-Aer came to be recognised as sturdy in character, of good appearance and providing trouble-free performance and long life. Many of the earliest units are still in operation today in all parts of the country.

The popularity of Frozt-ed-Aer, as the company's refrigeration products were named, and offered as an all British product, soon necessitated extensions at the factory which originally was at Ashton-under-Lyne—in the Crowthorn district—from which the company derived its name. But when it was seen that the land available would not continue to be adequate for necessary expansion the desirability to move to a new area became obvious.

In 1932, therefore, the present premises and site at Reddish, Stockport, were secured ; and the foresight then shown has been entirely justified. The situation is appropriate from every angle, being in a reputed engineering district, where adequate and suitable labour is available, and the site itself is all to be desired. The company is adjacent to the railway line connecting Yorkshire with the main line to the South from Manchester and the North, and it possesses its own sidings.

With about four acres of land and suitable buildings and offices the company appeared from the start to have ample accommodation, but since then, with continued expansion, it has been found necessary to add constantly to the space to keep pace with developments.

Looking back over the passing of time one realizes what advances have taken place. Compared with modern standards, the old SO_2 compressors were large, and air-cooled condensers in those days were simple banks of gilled copper tubing. To say the least, there was nothing streamlined about them. Changes in design came naturally with the adoption of the preferred refrigerants—methyl chloride and "Freon"—and the difference can well be compared with what has taken place in the motor vehicle industry, where speed with reliability and economy are the first considerations.

The refrigerating unit of today is an example of fitness for purpose, and efficiency is secured in various ways including the adoption of a highly efficient de-frosting system to enable maximum evaporation of the refrigerant to take place and do away with the "old snow man" of the coils which were the bugbear of the busy butcher and others.

Similarly, the design and shape of evaporator coils have come to be changed—the trend being towards the unit forced-draught cooler, with its relatively higher efficiency, which takes up less valuable room in the refrigerated space.

The modern cold room likewise is far removed, in appearance at any rate, from the old "box" which in design was a relic of the ice box on which the food industry had to rely before the automatic refrigerator ousted it as being both messy and inefficient. The old T. & G. in and out, with square corners, usually grained and varnished, having plain galvanized hinges, has given place to cabinets which are attractive in appearance, have rounded corners, and a gleaming white exterior, finished off with chromium plated hinges and fasteners which appeal to the public, and accord with its education in the high standards of hygiene.

But the company has not confined its productions to any particular trade, but has covered the whole range of commercial refrigeration, which includes the requirements of the farmer and dairyman and his requirements for milk cooling and storage, and deep freeze which has latterly come to the fore both in the processing of foodstuffs and for the storage of frosted foods.

The demands imposed on the milk industry have revolutionized the business of the milk producer and retailer, and the company's brine and D.X. coolers are consequently to be found in both large and small farms throughout Great Britain, preference having generally been given to the brine type which has the merits of simplicity and reliability, being so well suited to the hard treatment most equipment gets on the farm, whilst H.T.S.T. sets have met the needs of the towns.

In the way of display, the company's designs have accorded with modern trends in which the glass makers have contributed by making available suitable multi-pane units which when incorporated in cabinets obviate steaming up and excessive condensation which militate against effective display.

Frozt-ed-Aer has by no means been confined to "on land" installations but has equipped a large number of vessels with refrigerated food storage for both passengers and crews. In the industrial range, the application of Frozt-ed-Aer has been a wide one covering general air-conditioning, and the requirements of the photographic trade, paper-making, cloth conditioning, scientific and commercial research laboratories, and not least special cabinets for work in connexion with aircraft and atomic energy.

WILLIAM DOUGLAS & SONS LTD.

IN 1898 the firm had been in existence for 10 years and the four directors were the original founders, William Douglas and his three sons, Thomas, John and Loudon Macqueen Douglas. Equipment for the food and meat industries was then being manufactured at Farringdon Road, but in 1899 the present site at Putney was acquired and refrigeration became, as it remained since, the predominant interest.

For some years before 1899 William Douglas & Sons Ltd. were agents for J. & E. Hall CO_2 machines. However, Thomas Douglas, who was a chemist by training, was much impressed by the performance of SO_2 machines in Germany, as made by Messrs. Borsig and others, and in 1899, it was decided to manufacture them. At first the plants were used mainly for milk cooling and for the storage of meat, especially for local dairies and butchers who were large enough to consider using refrigerating plant. In the milk cooling competition at the 1905 Dairy Show the Douglas-Conroy SO_2 refrigerating plant was considered to be the best for low power consumption, low water consumption, and simplicity of construction.

The manufacture of the SO_2 machines was continued through World War I, and afterwards for a year or two. Realizing the limitations of these machines, however, the firm decided to turn over to using ammonia as the refrigerant. The design and development were, appropriately enough, mainly carried out by Thomas Douglas's son, William Stoddart Douglas. 1926 saw the fruits of this work in the shape of two ranges of ammonia compressors. One range was of the return flow type with plate valves in the cylinder heads and with splash lubrication. Although this type of compressor is now considered to be completely out-dated, there must have been something about them for there are in fact a great many of these earlier ammonia machines still running, with very little trouble.

The second range of machines introduced in 1926 was of the uniflow pattern with the suction valve in the piston. These machines were run at higher speeds and had pump lubrication. After a year or two it was decided to retain the return flow principle in the smaller sizes of compressor but the larger sizes were changed to the uniflow and force lubricated pattern.

In 1927 automatic control was introduced. The first of such plants were installed in butchers' cold rooms and through studying them more knowledge of automatic control was built up.

In 1936 the first fully automatic installation of any size including two 36-h.p. compressors was completed for the Admiralty. Although many much larger automatic plants have been carried out since, this was, at that time, believed to be the largest fully automatic installation in the country.

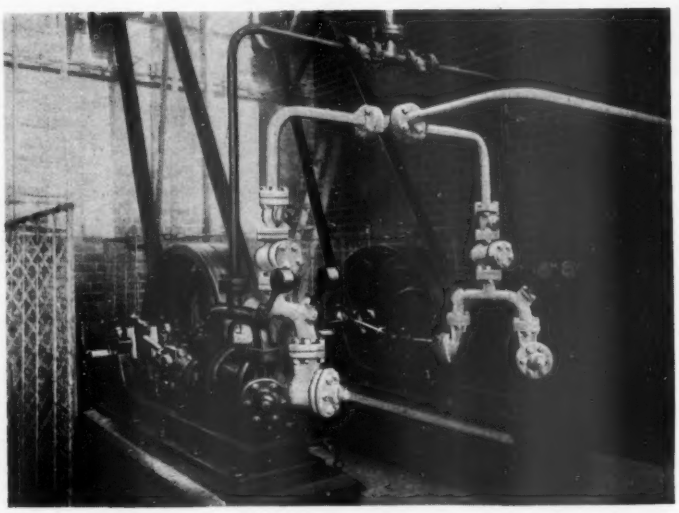
From about the turn of the century the firm had made a positive acting rotary pump and in the early 30s a modified form of this pump was developed for circulating liquid ammonia in the low pressure side of flooded systems. The first of these pumps was installed in 1932 and it is still performing its duty satisfactorily.

No mention has been made so far of the firm's insulation department. From the early days of the manufacture of SO_2 machines the firm carried out its own insulating work. Before World War I, slag wool was used to a large extent, but the department had turned over entirely to using cork and corkboard by 1920 or so. In recent years other insulants have been introduced, but still by far the majority of the work is done in cork. In the early days large numbers of ice boxes were made and for certain duties these are still preferred to-day. The insulation department as well as carrying out insulation contracts, makes all the firm's cold room doors as well as some for the trade. Latterly there have been developments in the doors for low-temperature rooms including special fasteners and electric heating.

It has always been felt that it is a desirable thing for one firm to be responsible for both insulation and plant and it has been found that this policy has avoided difficulties which sometimes arise when responsibility is divided.

From the second range of ammonia compressors described earlier on a range of twin-cylinder monobloc machines was delivered with a further increase in the running speeds varying up to 520 r.p.m. These machines are still used to-day. They are all of the uniflow pattern with pump lubrication and are arranged with half-duty valves. Alternative arrangements have been made for using seals instead of packed glands and on the smaller sizes the design is arranged for a seal only.

Before World War II, small plants using methyl chloride



Two Douglas horizontal, double-acting, SO_2 compressors serving a Scottish Co-operative Society installed just before World War I.

were developed and worked very satisfactorily but after the war, owing to the heavy demand for edible fat plant and animal by-product plant as well as industrial refrigerating machines, it was found not possible to continue with the small machines, at any rate not on the scale on which it was judged such manufacture should be carried out.

For two-stage compressors the firm originally used the three-cylinder machines of the intermediate range using two and one cylinders. For smaller duties, a differential piston machine was developed which gave most satisfactory results. However it was decided to fall in with common practice and produce a range of two-stage machines built on the monobloc crankcases with L.P. and H.P. cylinders side by side.

Before and after World War I, condensers were made of the double pipe, submerged or atmospheric types. Submerged evaporators were used on brine plants. In the 30s a range of shell and tube condensers and evaporators was produced but although re-coolers were often used with shell and tube condensers it was found that there was still a demand for natural draught atmospheric condensers. After World War II, a range of induced draught evaporative condensers was designed and these have now largely superseded the natural draught type.

As an alternative to the shell and tube evaporator and storage tank for brine, and for chilled water, a raceway cooler was developed with short vertical coils using a flooded system. The coils were originally wound as short spirals but are now of the even shorter double-bend type and the unit is situated in a raceway with propellor agitation for circulating the brine or chilled water. To meet current demands, a considerable number of chilled water cooling tanks of this type have been supplied for industrial air-conditioning and for dairy work.

Since World War II, more attention has been directed towards quick-freezing and low-temperature storage. Finned tube cross-flow air coolers with water defrosting and heated trays and outlets have been developed for this work. Two years ago this culminated in the acquisition of the drawings and patents of the S.B. Engineering Company. By the addition of these, the firm now has a range of designs for a number of different types of air-blast tunnel. In addition to those for freezing some are arranged for cooling at higher temperatures. Duties include ice cream hardening, poultry freezing, vegetable freezing and, at higher temperatures, pie and sausage cooling and confectionery cooling. The knowledge gained with this plant is being applied in other directions as well.

Further development work on compressors is in progress in keeping with the present trend towards higher speeds.

FRIGIDAIRE DIVISION OF GENERAL MOTORS

FRIGIDAIRE sold the first automatic household refrigerator in Britain in 1923. Imported from the United States, it was marketed with others that followed by the General Motors organization then established at Hendon. This organization continued to develop the sale of imported Frigidaire products and in 1932 the sales volume justified setting up manufacturing operations in England for the production of commercial condensing units, evaporators and household cabinets designed specifically for the British market.

During the war years—1939 to 1945—Frigidaire, Hendon, continued to manufacture refrigeration equipment in large quantities for war purposes. Vital food stores, blood and plasma storage, low-temperature equipment for artillery and ammunition testing were all undertaken in addition to the large-scale manufacture of self-sealing aircraft fuel tanks.

During these years the Frigidaire dealers' service organizations remained intact, engaged in the vital work of reconditioning and maintaining refrigeration equipment being used for war service and food supplies throughout Britain. Many members of Her Majesty's Forces were given training at the Hendon factory in the installation and servicing of refrigeration and air-conditioning plant.

After the war, in the early summer of 1946, work was started to carefully prepared plans for the general reorganization of the Hendon plant. The object behind these plans of intensification and improvement of existing production methods was the ultimate aim of higher quality and larger quantity production.

The operation had been divided into stages, the first being to determine machinery, processing and conveyor requirements and to lay them into an overall plan to give a smooth production flow. The second stage incurred changes which could be effected without interrupting the existing production flow. These changes saw, among others, expansion of the machine shop, new and much larger paint and vitreous enamelling plants, new assembly lines and about a mile of conveyors. At the same time, a quality control department was set up, the existing departments of inspection and laboratory being merged to form the basis of the new section reporting direct to the general manager.

The following year a complete new shop was installed for the production of the "Meter-Miser", the hermetically sealed, rotary compressor which had been originally introduced by Frigidaire, Dayton, in 1934. The first of these units came off the Hendon production lines on November 22, 1948.

Parallel installations were also being made in the press and sheet metal shops where new presses and electric resistance seam welders were introduced to assist mass production.

Manufacture of refrigeration controls was also commenced in 1948 after a period of intense activity when much of the special equipment was designed and built in the Hendon plant itself. Shaft seals, thermostatic switches, modulex expansion valves, pressure switches, water valves—all were added to the growing list of products coming off the Frigidaire production lines. In the short space of two years the plant output increased sevenfold.

During these years considerable advances were made in design, marked improvements in style and performance being effected on all products. The range of household refrigerators, ice cream conservators and commercial cabinets was gradually increased, size, feature and internal detail becoming more comprehensive as the market demanded.

The experimental and development sections were especially busy in those first few years after the war. The home market was clamouring for products of which it had been starved for six years but, in addition, the Frigidaire organization spread all across the world was looking to Hendon as a source in the sterling area. Old products were improved, new products were developed and proved and the range extended, especially in the commercial field.

In the succeeding years, with both domestic and export sales volume increasing in rapid strides, further large expansion plans were formulated and carried out. Productive area was increased following the building of a new administrative block and substantial new equipment was installed including an automatic pickling plant and an exceptionally large brazing furnace.

Early in 1957 the Frigidaire Division of General Motors Corp. in the United States decided to devote their production facilities to the fields of household refrigeration and appliances and air-conditioning, leaving the production of commercial refrigeration equipment for the world's markets to be catered for by Frigidaire Hendon. Plans for increased

production had thus to be further expanded and on June 6, 1957, Frigidaire Hendon announced details of its five-point development programme for commercial refrigeration with planned expansion in production, sales, service, training and export.

Production under this programme is to increase by 1960 to 50 per cent. over what it was in 1956. Cost savings, due to increased production and more efficient manufacturing techniques, will be passed on to customers in lower prices and an extensive system of training is to be carried out. At the same time new plant is being introduced to meet the demands of an increased export potential.

Some effects of this development programme have already been registered. In November, 1957, after only nine years' production, Hendon's 1,000,000th sealed rotary compressor came off the assembly line, while price reductions on ice cream conservators, frozen food display cases and a series of evaporators have all been made in recent months. A five-year warranty on all commercial condensing units also came into effect last year.

At the end of last month it was announced that as a result of this expansion programme, 1957 was an all-time record year for sales of English Frigidaire products.

* * *

J. & E. HALL LTD.

WHEN the first issue of this periodical was published in 1898, the firm of J. & E. Hall Ltd. had already been manufacturing and selling refrigeration plant for nearly 20 years. In 1880 we put our first refrigeration machine on the market ; it was a modified version of the Giffard cold-air machine brought over from the International Exhibition in Paris three years previously. This was followed in 1887 by a " vapour compression " plant operating on CO_2, which was manufactured under licence from Franz Windhausen. The CO_2 machine proved to be very successful and from then onwards, J. & E. Hall led the field in marine refrigeration, to an extent which somewhat overshadowed their land business. Due to the steady demand for CO_2 machines, it was not until 1910 that we began to design and manufacture ammonia compression machines which were more suitable for use on land installations where the main disadvantages of its use on board ship do not apply.

The main type of refrigeration machine, therefore, being manufactured by J. & E. Hall Ltd. at the turn of the century, was the " CO_2 vapour compression refrigerating machine " for use in ships for the carriage of meat, for preserving food generally and for producing ice ; also large installations in breweries and smaller plant in dairies, etc.

The first machine, as described in Mr. E. Hesketh's book on J. & E. Hall Ltd., " consisted of a two-stage compressor, the primary compression being effected in the rear half of a horizontal cylinder fitted with piston ; the gas therefrom was taken to a vertical cylinder attached to the front part of the horizontal cylinder. The latter with the vertical cylinder was filled with glycerine which moved up and down in the vertical cylinder as the piston of the horizontal cylinder moved backwards and forwards." " The use of glycerine and two-stage compression was soon discarded and a simple double-acting compressor took its place." Many difficulties were encountered in these early stages but gradually they were overcome by means of new inventions and improved designs, so that although the principle of the machine in use to-day is the same as all those years ago, the design of the machine itself has changed almost beyond recognition, as can be seen from the illustrations.

For a firm such as ours, which manufactures many " tailor-made " installations, it is very difficult in this brief space to mention all the types of machines we have manufactured during the past 60 years. We shall, therefore, have to be content with a short list of some of the main types. In 1903, we were advertising in our marine refrigeration catalogues :—

Vertical single CO_2 machines.
Vertical duplex CO_2 machines.
Horizontal duplex CO_2 machines.

(At the same time we were also still making a few cold-air machines for special purposes.)

On the land side we were offering :—

Horizontal duplex CO_2 machines.
Horizontal single CO_2 machines.
Small size CO_2 machines.

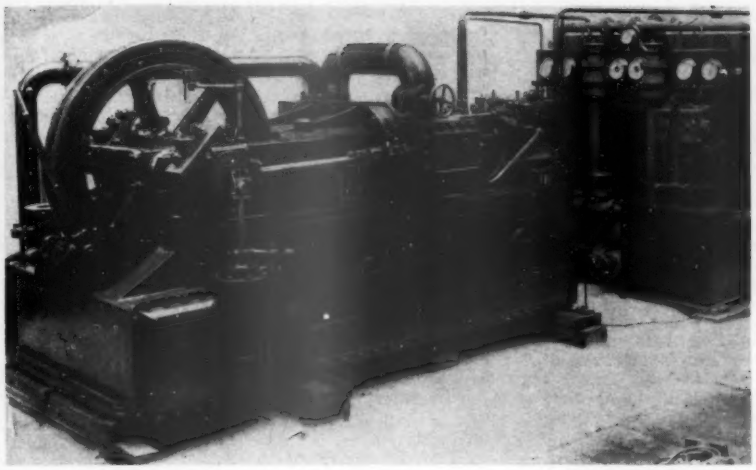
Most of these could be either steam or belt driven.

(We were also at this time producing plant for the collection and liquefaction of CO_2 gas from breweries.)

To this range we added the horizontal and vertical land type ammonia compression machines which could also be either belt or steam driven. Ammonia compressors were made with one, two or three cylinders, and by 1921 were beginning to bear some resemblance to their present-day counterpart.

The slow-speed horizontal compressor at 50 to 150 r.p.m. and the vertical single-acting medium speed compressors at 150 to 250 r.p.m. were gradually superseded by high-speed vertical compressors and the monobloc vertical compressors running at from 300 to 600 r.p.m.

On marine installations, one of the most important requirements was saving of space, and with the introduction of motors with increased speeds it became possible to reduce



An early Hall duplex marine type CO_2 machine.

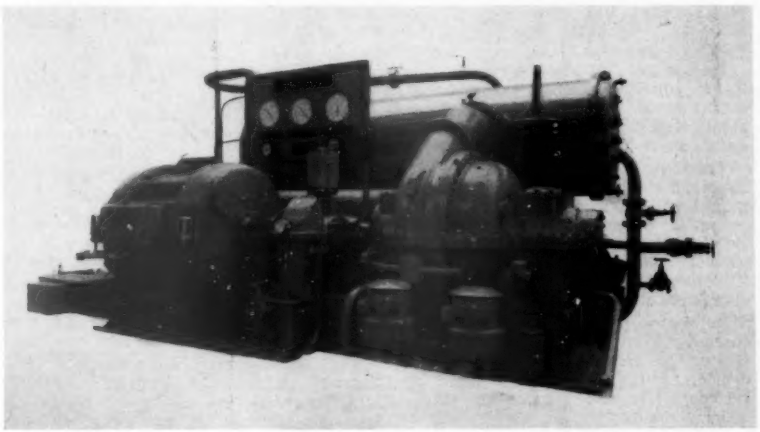
the size of the compressors. There were also many improvements such as the replacement of poppet valves by ring valves.

Until about 1925, there were very few refrigerators in retail shops, so that when small refrigerating machines working with automatic control and requiring no skilled attention from the user became available, they were quickly adopted. Butchers were naturally the first to use these machines but they were soon followed by other retailers of perishables. On January 1st, 1928, J. & E. Hall introduced the " Hallmark " automatic refrigerating machine using methyl chloride as the refrigerant and in the face of keen competition quickly built up a very large business in the sale of this equipment.

Coming to the present day, the range which we cover, of a capacity taking from a fraction of a horse-power to 1,500 h.p. or more is provided in the lower sizes by our Hallmark multicylinder vertical and veebloc compressors ; in the medium and larger sizes by our veebloc ammonia and " Freon " (" Arcton ") compressors for single-stage operation ; by an extensive range of two-stage compound compressors for high compression ratio operation such as is required for very low temperature work, and finally by centrifugal compressors used mainly for large industrial and air-conditioning requirements.

We have dealt mainly with the improvements in refrigeration machines, but, of course, J. & E. Hall themselves also manufactured most of the equipment that goes to make up a complete refrigeration installation and there were many improvements in this direction. To quote but one example —in early marine installations difficulty was experienced with the great lengths of brine piping required in meat holds. The firm overcame this difficulty by inventing the brine grid. This invention was made possible by the fact that the works had, in about 1890, been almost the first in England to introduce electric welding. The use of these brine grids resulted in a reduction in the number of joints to be made in the piping and greatly reduced the cost of erection. We subsequently developed the cross-grid air-cooling battery and many forms of other air coolers which in their turn have largely replaced the brine grid.

In conclusion, the range of applications of our refrigeration and air-conditioning plant has increased enormously over the years, and refrigeration in some shape or other



Hall's latest centrifugal refrigeration plant.

enters virtually into every phase of everyday life, and almost every industry.

In passing, we would mention that J. & E. Hall Ltd. have always endeavoured to maintain more than one line of manufacture. From 1906 to 1926 they built heavy motor vehicles which were given the name of " Hallford." When this ceased, they turned to the manufacture of lifts and later, in 1931, escalators and have continued to manufacture " vertical means of transport " with considerable success.

KELVINATOR LTD.

KELVINATOR refrigeration traces its ancestry back in a direct line to the very first domestic electric refrigerating unit built; in 1914 Nathaniel Wales started to build in America the first series of refrigerating units which were later to be known as Kelvinator. After many experimental models had been made and tried, each one an improvement on its predecessor, the newly developed model was, in February, 1916, considered ready for production and sale. A company was then incorporated.

In the month of July, 1916, the organization became known as the Kelvinator Corporation, this name being chosen in honour of Lord Kelvin of Largs, Scotland, the 19th century British scientist who pioneered the discovery of the principles upon which mechanical refrigeration is based.

In 1926 Kelvinator Ltd. was established in London. At the beginning the company was assembling American-made refrigerator components, for sale in the British home market. The assembly plant—off the Gray's Inn Road—was partly burnt out and demolished during the blitz.

During the second world war, Kelvinator Ltd. made a contribution to the field of ultra-low temperatures for testing aeroplane components and instruments under high-altitude conditions, a field of research which saved the lives of many of our allied aircrews. As a further contribution to the war effort, hundreds and thousands of sheet metal parts and containers were manufactured by Kelvinator, also many high priority air-conditioning and refrigeration installations were carried out.

Because of the dollar situation after the war, and the impossibility of importing the necessary parts for assembly, the company decided to manufacture completely in England. The London plant was not suitable for this, so premises were acquired at Pym's Lane, Crewe, where the manufacture of complete refrigerators commenced in 1946. The sales, home service and advertising departments remained in London, where they are now located on the Great West Road at Chiswick.

During the first seven or eight years of production at Crewe, absolute priority was given to the needs of the export market. This was done in support of the Government's export drive. At one time 80 per cent. of the company's entire production was being exported.

The Crewe factory manufactured household refrigerators so suit all family requirements, from small working table-top models to large family-size models. Kelvinator pioneered automatic defrosting in household refrigerators in Great Britain. All Kelvinator household refrigerators are now powered by the famous " Polarsphere " sealed unit, in which the oil is permanently sealed, never needs refilling, and is guaranteed for five years.

Kelvinator have very great experience in the field of commercial refrigeration for all applications. The company produce ice cream conservators, beverage coolers, display cabinets, storage cabinets, self-service counters, etc., and a very comprehensive range of compressors and refrigerating systems suitable for all low horse-power applications, of which a few are butchers' and fishmongers' cold rooms, fruit storage, bread freezing—in which Kelvinator were the pioneers in this country and which application of refrigeration is developing rapidly.

While the manufacture of complete refrigerators and refrigeration equipment has only been undertaken in Great Britain by Kelvinator during the last 12 or 13 years, the company has the benefit of over 40 years in the design and manufacture of domestic refrigerators. Kelvinator are now counted among the foremost refrigeration manufacturers in Great Britain.

Although refrigeration in this country has as yet only scratched the surface of the potential market, early in 1956 it was felt the company's production facilities at Crewe were not sufficient to cope with the large orders which were rolling in. Therefore plans were made to acquire additional premises at Bromborough, some 30 miles from Crewe. The new factory, which has a floor space of 320,000 sq. ft., is being constructed by the Government for lease to Kelvinator Ltd. and will, when completed, be the largest factory ever constructed by the Government for lease to private industry.

It is anticipated that the Bromborough factory will ultimately employ 3,000 people. The land and building will cost approximately £1,000,000, and by the time the plant is completely equipped, Kelvinator's own investment will have more than doubled this sum.

Foundations were laid in June, 1956, but in September, 1956, a disastrous fire destroyed about 60 per cent. of the Crewe factory. This was regarded as one of the major fires in this country since the war. Luckily, the fire occurred while very few employees were on the premises, thus there was no loss of life or serious injury. This disaster almost completely brought manufacturing operations to a standstill and production could not cope with outstanding orders for both home market and export. Arrangements were made with the building contractors to speed up the building programme at Bromborough and before the end of 1956 a household refrigerator assembly line had been laid down in one corner of the new factory and as more space was completed other sections were added, and the new plant is rapidly approaching completion.

Early in 1957 the first household refrigerator which had come off the new assembly line of Bromborough was presented to the local Dr. Barnardo's Home by the Mayor of Bebington—Councillor J. H. Williams—who had been asked by the company to select a charitable organization to receive it.

In spite of the hampered production caused by the fire at Crewe, household refrigerator sales on the home market during the company's last fiscal year were doubled and commercial sales increased by about 30 per cent., which we feel is no mean achievement.

On the completion of the new factory at Bromborough, it was Kelvinator's original intention to manufacture all cabinets there and continue production of compressors and refrigerating system at Crewe. However, it is now felt it will be impossible sufficiently to expand our operations there. At Bromborough there is an area of over 18½ acres for expansion as it becomes necessary and also it will be much more beneficial for all concerned to have our entire manufacturing operations under one roof. It has, therefore, been decided that the Crewe operations be transferred to Bromborough. The complete transfer will be effected over the next 12 to 18 months.

As we vacate areas at Crewe they will be taken over by Rolls Royce Ltd., whose premises adjoin our own, so that they in turn may extend their activities.

Even though we shall eventually leave Crewe our company will still continue to provide employment for a great number of Cheshire people. Many of the people now employed at Crewe will go with the company to Bromborough.

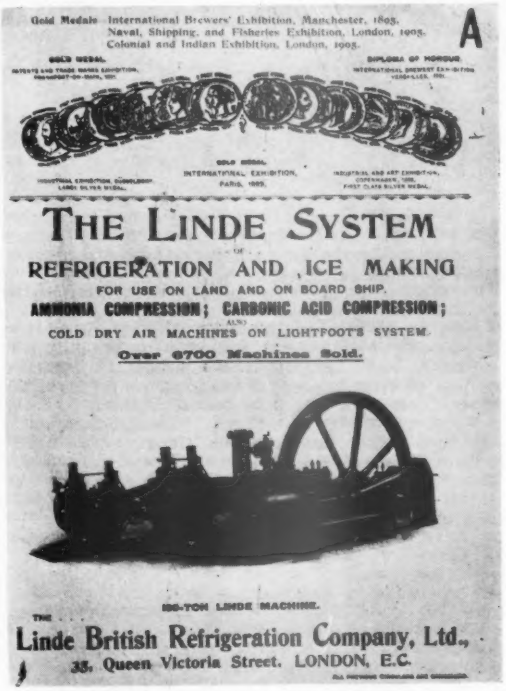
THE LIGHTFOOT REFRIGERATION CO. LTD.

SOME of the gentlemen who like to call themselves "licensed practitioners in advertising" frown severely on any suggestion that historical matter should be used in publicity. They imply that there is something not quite respectable about having been in business for a long time and that customers are more influenced by the latest advertisement in the latest magazine than by the reputation of the supplier.

Yet it is frequently observed that most of the worthwhile advances in science and engineering seem to be made by firms who have been operating for very many years and that they are usually first described in established magazines who cling obstinately to a preference for solid reading matter rather than glossy covers. It is, therefore, a particular pleasure to be able to congratulate MODERN REFRIGERATION on its 60th birthday and to find it still growing and improving efficiently and without fuss.

We, in the Lightfoot Refrigeration Company, are, also, unrepentantly proud of our even longer career and find little difficulty in convincing ourselves and our many friends that we have not stopped growing yet.

We take our name from Thomas Bell Lightfoot, of whom it is recorded ("History of the Frozen Meat Trade," by


Gold Medals International Brewers' Exhibition, Manchester, 1803.
Naval, Shipping, and Fisheries Exhibition, London, 1905.
Colonial and Indian Exhibition, London, 1905.
A
THE LINDE SYSTEM
OF
REFRIGERATION AND ICE MAKING
FOR USE ON LAND AND ON BOARD SHIP.
AMMONIA COMPRESSION; CARBONIC ACID COMPRESSION;
AND
COLD DRY AIR MACHINES ON LIGHTFOOT'S SYSTEM.
Over 6700 Machines Sold.
100-TON LINDE MACHINE.
THE . . .
Linde British Refrigeration Company, Ltd.,
35, Queen Victoria Street, LONDON, E.C.

From an early Linde British catalogue.

Critchell and Raymond) that "not only did he, in 1880, introduce an improved cold air machine in which the expansion was performed in two stages, but he was also the designer of what was probably the first commercially successful ship's refrigerating plant in which a chemical refrigerant was used. This was Turnbull, Martin & Co.'s *Perthshire* in 1887 which had an insulated hold capacity of 25,000 carcases for bringing frozen mutton from Australia to this country. The s.s. *Elderslie* which was the first steamer specially constructed for the New Zealand refrigerated shipping trade and loaded her first cargo in New Zealand in 1884, was equipped with one of the Lightfoot dry-air refrigerating machines. This was followed in 1889 and 1891 with six more similar type machines, each having a capacity of 55,000 to 60,000 carcases of sheep. This was actually the beginning of a plentiful supply of meat at low prices to fill the wants of the poorer classes in this country."

He later became associated with Professor Carl von Linde and the Gesellschaft fur Linde Eis Maschinen, of Wiesbaden, in The Linde British Refrigeration Co. Ltd. founded in 1885 and took over the management of this British company a few years later.

The Linde British Company designed and produced air, ammonia and carbon dioxide refrigerating plants using steam-driven horizontal compressors for cold stores and ice factories. When it found some hesitation among potential customers to rely on mechanical refrigeration for cold storage, it promptly set up a number of cold stores and ice factories itself to demonstrate the reliability of its products and gain operating experience with new developments.

Many Lightfoot installations dating back to before the Boer War are still operating effectively but require replacement spares from time to time which provokes much research into the famous "black order books" of the company where all details of all installations are carefully recorded.

In 1916 the association with Linde ceased and the company assumed its present title but on August 4, 1921, T. B. Lightfoot died after a short illness, having attained the age of 73.

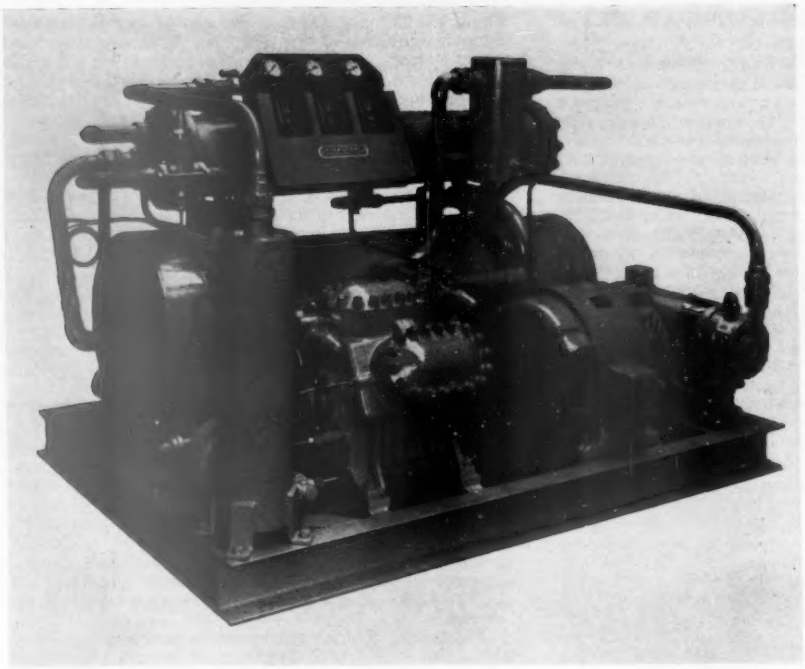
Throughout his long and successful career he had always demanded from himself and from his associates the highest standards of competence and integrity and he did much to give the British refrigeration industry, from its very beginning, a status comparable with the best of the other professional engineering bodies. At the same time he had a gift for friendship which balanced his strong personality and instilled a fierce personal loyalty in the staff of the company which is his true memorial.

With his passing the leadership of the company passed into the safe hands of his son, Kenneth Lightfoot, who had gone from Leeds University to Davey Paxman Ltd. for thorough practical training before joining the company under his father in 1908. Apart from service throughout the first world war as an officer in the Royal Engineers, he has remained in the company ever since and held the office of managing director for 35 years (1921–56).

He not only adhered firmly to the policy of uncompromising insistence on the best which his father had laid down but he extended this influence to an ever-widening circle in various capacities including the presidencies of the Institute of Refrigeration and the National Federation of Cold Storage and Ice Trades.

The first decade of Kenneth Lightfoot's leadership was a period of very rapid growth in the company and, in 1926, what was to be a most important development appeared in the shape of the first "Ellarcold" machines. These were relatively small automatic plants using methyl chloride and for some time the enthusiastic "Ellarcold" team were treated with some reserve by the older members of the family. However, the new "brother" grew vigorously, producing larger and larger installations of ever-increasing efficiency and changing from methyl chloride to the "Freon" refrigerants. Eventually the turnover in "Freon" applications exceeded that of ammonia plants and the two departments were merged to the mutual advantage of both.

Nowadays, research and development are directed towards producing new compressors, condensers, coolers, etc., suitable, with appropriate modifications, for both "Freon" and ammonia applications and the choice of



Latest self - contained refrigerating set (this will be shown at the Brussels Exhibition) made by Lightfoot's.

refrigerant is determined solely by the particular requirements of each job.

Although we do a substantial and rapidly expanding business in standard packaged equipments such as conservators, display cabinets, commercial refrigerators, drinking water coolers, air-conditioning units, large water-chilling plants, etc., we still regard ourselves primarily as "tailors" rather than "outfitters." Each enquiry or invitation to tender which we receive is allocated to one of our senior contracts engineers who is, thereafter, responsible for it right through to final test and hand-over to "his" customer.

This policy is another legacy from our history of which we take particular pride and have every intention of continuing for the next 60 years.

We are, perhaps, not very willing to rush into production with versions of the latest gimmicks. We believe that new designs should evolve from original research and that they require comprehensive study and prolonged testing before being offered. As in the case of film actresses, fashionable vital statistics are no substitute for real ability.

Nevertheless, we have managed to bring out quite a number of modern designs within the past year or two aiming all the time at the maximum flexibility in order that we may continue to adapt ranges of standard components to the precise requirements of each application.

In this we believe that our policy is similar to that of the editor of MODERN REFRIGERATION who contrives to bring out a succession of new and interesting features designed to meet the evolving needs of this industry. We, therefore, look forward to continuing our friendly collaboration with him.

* * *

MARCO REFRIGERATORS LIMITED

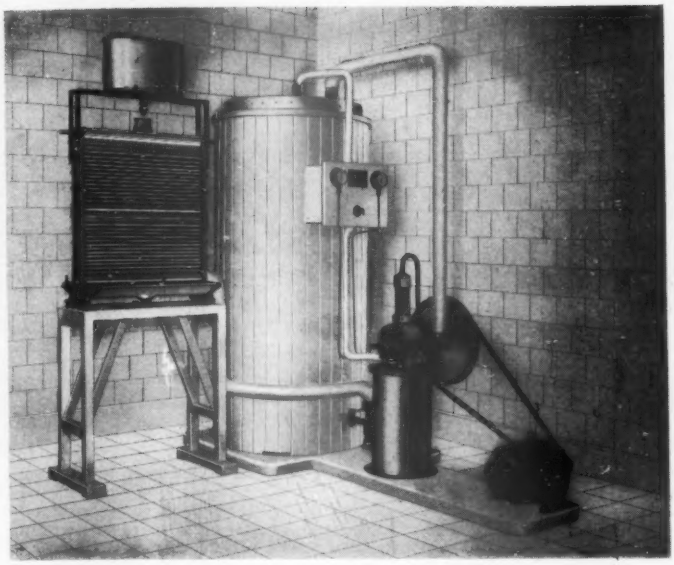
SIXTY years ago was the year 1898 and in that year the predecessor of Marco Refrigerators Limited was a private enterprise controlled by a Mr. J. Fulford, grandfather of the present secretary and assistant managing director of Marco Refrigerators Limited, Mr. E. A. Leach.

Mr. Fulford's business had, however, already been in existence over 50 years concentrating from 1845 to 1903 on the manufacture of domestic and commercial type ice cooled refrigerators or ice boxes. The factory during that period was situated at Oakley Street, Westminster Bridge Road, S.W.1., and in 1903, just before moving to different premises at Crampton Street, Walworth, S.E.1, Mr. Fulford produced his first ammonia condensing unit.

In 1904 a partnership was formed and operated under the name of F. R. Martin & Company, from which name the trade-name "Marco" was coined. In 1912 this company moved to Boundary Lane, Camberwell, S.E., finally settling at their present address, Rowan Road, Streatham, S.W.16, in 1915.

In 1926 a private limited company was formed to take over the partnership of F. R. Martin & Company operated by Mr. Richard Alfred Fulford (son of John Fulford the founder) and Mr. F. R. Martin.

In May 1929 Marco Refrigerators Limited were incorporated as a public company and about this time produced their first SO_2 condensing unit. It is interesting to record that in the years 1904 to 1929, "Marco" ice boxes were as well-known as any ice box in this country



A natty milk-cooling plant. This won Marco's a medal at the Dairy Show in 1924 for efficiency.

Below: An early Marco ice refrigerator.

and in many parts of the world, and that small "Marco" ice boxes for domestic use could be bought in well-known London stores at retail prices ranging from £2 5s. each, such ice chests being heavily insulated, finished externally in grained oak and varnished, lined with galvanized steel with removable ice container, unbreakable shelf and lift-up lid secured with chromium plated hinges. There are important buyers in London to-day who still remember the amazing retail price of £2 5s.

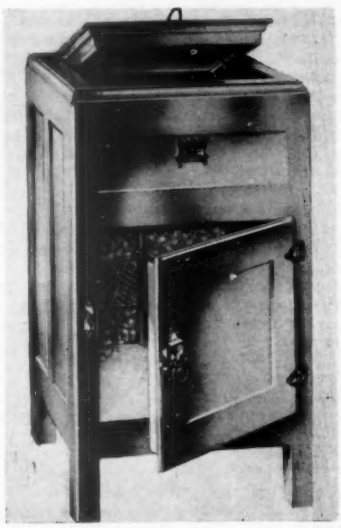
It is also interesting to record that in the years 1926/30, when automatic refrigeration was just obtaining a foothold in Britain, many of the butchers' ice boxes converted to automatic refrigeration were of Marco manufacture.

During the war years, 1939/1945, the company was engaged in the manufacture of special equipment for war purposes, but after the war resumed the manufacture of domestic and commercial refrigerators, discontinuing the former in 1952, and concentrating solely on commercial refrigerators of all types. In that year they produced the "Serviseal" serviceable hermetic condensing unit, a type becoming increasingly popular as the ideal condensing unit for small and medium commercial applications.

The decision to embark on this new venture was made by the then managing director, Mr. A. E. Leach, who served the company and its predecessors for a period of 44 years until his retirement in March, 1954, when he was succeeded by Mr. R. J. Simpson who is well-known in the industry. At about this time Mr. E. G. Batt (former director and secretary of British Refrigeration Association) joined the board and has been chairman of the company since the latter part of 1954.

The long history of Marco Refrigerators Limited has enabled them to gain vast experience in the insulated fixture field, and they are the only manufacturers in the country producing not only a range of the latest types of condensing units, evaporators and defrosting units, but also a complete range of insulated fixtures from 13 c.ft. service cabinets, to 1,000 c.ft. sectional cold rooms, and display fixtures from a 4 ft. refrigerated counter to 12 ft. open type frozen food, front vision, display cabinets, examples of which may be seen in many of the principal stores throughout the country.

The capital employed by the company has grown from £100 to over £200,000 ; extensive improvements have been made to the factory at Rowan Road, Streatham, during the last 40 years, the latest being a modern test and development laboratory which embodies the latest type of sound proof rooms for maintaining a high standard of efficiency and quietness in operation of the now famous "Serviseal" compressor.



PRESSED STEEL CO. LTD.

ALTHOUGH the history of Pressed Steel Co. Ltd., of which Prestcold Refrigeration is a division, does not reach back for the 60 years of which MODERN REFRIGERATION can boast, it does extend through 32 years. The company was formed in 1926 for the purpose of producing all-steel bodies for the automobile industry ; the ready adaptability of manufacturing plant and processes to certain other products soon afterwards resulted in the addition of refrigeration equipment as a product of the company. Since the plant and production methods in existence for the automobile industry were most readily adapted, in the first instance, to domestic refrigerators, a decision was made in 1932 to enter this market. Manufacture of domestic refrigerators commenced in 1933 and the brand name of " Prestcold " was registered. A few years later, in 1935, activities were extended to embrace commercial refrigeration.

In both these spheres rapid progress was made and in comparatively few years after the war Prestcold claimed to be one of the largest manufacturers of automatic refrigerators in Great Britain. In the meantime, however, the war had intervened and the factory was kept operating at consistently high pressure on production work essential to the war effort. Whilst this included products of a different nature such as sea mines, a good deal of refrigeration work was carried out, particularly in relation to the retardation of age-hardening of light metals in the aircraft industry. Important work was also done with regard to low temperatures for test purposes and in connexion with shrink fitting, whilst research and development were devoted to the production of refrigerators for temperatures in the range −50° to −80° C. with complete automatic control.

From both engineering and production viewpoints a milestone in the story of Prestcold progress was the manufacture, immediately after the war, of the first British-designed and built hermetically-sealed compressor.

Sociological circumstances applying throughout the nation as a whole now had their effect. To meet the desperate need for homes for the people, houses of the prefabricated type were erected in large numbers and a significant indication of the appreciation of the value of refrigeration was given by the authorities. They required domestic refrigerators of the built-in type in large numbers and the Prestcold 3-c.ft.-capacity model proved particularly suitable for this purpose. Meanwhile the Prestcold range was being extended constantly and progressed rapidly to a full range of domestic and commercial models and equipment.

To list all, or even a representative number, of the new models successfully introduced, or the improvements in design which marched in step with them, is impossible in this article. In the domestic field, however, reference should be made to the introduction of " colour-choice " refrigerators which enabled buyers to select tops and bases in varied colours to suit their particular tastes, and of the introduction of the capacious T.801 model. Claimed as the most modern British refrigerator on the market, it included two temperature zones, for storage and deep freezing respectively, and automatic defrosting. In the present year of 1958 an even more advanced form of this design has been introduced under the title of the T.901 " Automatic Nine." In the small refrigerator field another design of outstanding interest is the Packaway model which is available in forms suitable for wall mounting, building into kitchen units, or free-standing use.

Mention has already been made of the Prestcold hermetically-sealed compressor and another milestone along the path of progress which must be mentioned is the introduction a year or so ago of a full range of Super-Presmetic commercial compressors and condensing units. Now the present year of 1958 sees the introduction into the Prestcold range of a hermetically-sealed rotary compressor.

Since its inception the development of commercial refrigeration equipment has been rapid, both in the form of packaged models and equipment suitable for many and widely-varied purposes. Again, these are too numerous to list, but some instances can be given. The comparatively recent trend in foodstuff retailing towards refrigerated storage and display cases has been actively stimulated by the development of Prestcold models in variety to meet every retailing aspect. Equipment has also been specially designed and engineered to meet many individual needs in agriculture, medicine, industrial research and other fields. An outstanding example is the hypo-hyper-thermia apparatus used in certain delicate major surgical operations, a number of which could not be carried out at all without its aid. Blood and bone banks are other examples of medical applications and so is the production of penicillin and streptomycin with the aid of Prestcold equipment. Agriculture is benefiting from Prestcold equipment used in conjunction with apparatus to study the effects of light, temperature and humidity upon plant growth and development. Industry is using refrigeration equipment in many ways ; the manufacture of automobile engines capable of easy starting in extremely cold climatic conditions, the performance of aircraft components at high altitudes and even the manufacture of golf balls and cosmetics are all being carried out with the utmost efficiency with the aid of Prestcold equipment. Many famous names appear on the list of Prestcold users, but the peak of achievement in this respect was reached with the granting to the company a year or two ago of the Royal Warrant of Appointment as suppliers to Her Majesty the Queen, followed a short time afterwards by another as suppliers to Her Majesty Queen Elizabeth the Queen Mother.

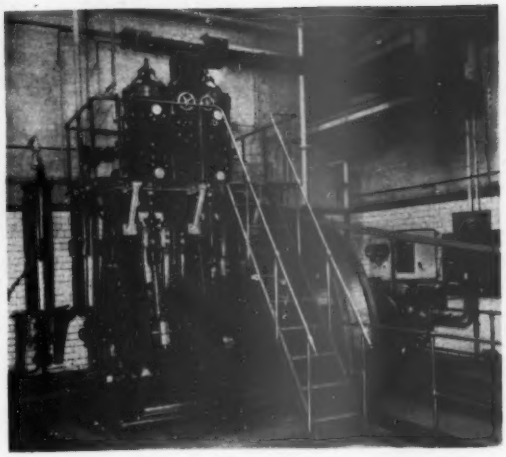
L. STERNE & CO. LTD.

IN 1898, L. Sterne & Co. was building the De La Vergne ammonia compressor. This was a large vertical open-type compressor which ran at 40 or 50 r.p.m. and had a complicated arrangement for injecting oil into the cylinder to fill up the clearance spaces and to seal the piston packing and glands. A compressor of this type installed in that very year was operated continuously until 1932 when it was relegated to standby service. It continued to be run from time to time and was only replaced in 1957. There are two of these machines built rather later still in regular use in London.

About 1905 a range of small low-speed vertical enclosed ammonia compressors was introduced. These compressors ran at 150 to 200 r.p.m. About 1910 this company started to build large horizontal, double-acting, ammonia compressors, but relatively few of these machines were made before they were superseded by what at that time was called high-speed vertical enclosed machines.

The first of our high-speed vertical machines to the design of the late Mr. L. Chew was built in 1921. Although they have been developed and improved, machines to the same basic design are still being built to-day, not only as ammonia compressors but also for compressing fluorinated hydrocarbon refrigerants. In recent years the company has introduced a range of high-speed V-type compressors for ammonia and other refrigerants. These machines, however, are really a logical development of the original vertical enclosed machine built in 1921.

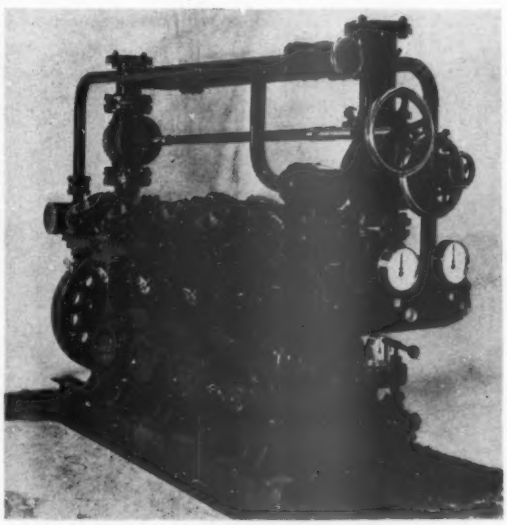
In parallel with the development of improved compressors, tremendous strides have been made in the design of the rest of the refrigerating plant. In fact, without these advances the development of improved compressors would have served little purpose, even if it had been possible.



A belt-driven De La Vergne compressor similar to those being supplied in 1898.

The most important step has perhaps been the realization that if a compressor is to work efficiently it must be provided with a dry and at least slightly superheated vapour to compress. This has led to the replacement of the "hand expansion valve" by various forms of float valve or by the now commonly used thermo expansion valve.

A more gradual but probably more important step forward was the reduction in the length of individual evaporator circuits, which, combined with improved control of liquid supply, produced a marked improvement in efficiency. The logical application of the published results of investigations into the mechanism of heat transfer has been, and still is, producing remarkable developments in the design of condensers and evaporators, with improved use being made of available heat transfer surface.



A mark 8VQ, 8 cylinder, V type compressor of Sterne's latest design.

The introduction of the range of fluorinated hydrocarbon refrigerants in recent years has, while solving a number of problems, introduced many new ones peculiar to these refrigerants. The basic principles still, however, remain, so that a change of emphasis is involved rather than a revolution. It is doubtful whether the 100th anniversary of MODERN REFRIGERATION will see ammonia entirely superseded unless some unforeseen development puts the whole science and practice of vapour compression refrigeration into the museum class !

Fluorinated hydrocarbon refrigerants have permitted the rapid development of the smaller equipment for commercial and domestic applications. In 1935 arrangements were made whereby this company built open-type compressors in this range to the design of the Universal Cooler Company of Canada and improved machines to the same basic designs are still being built in sizes up to 20 h.p.

In 1947 the company completed a further agreement for the manufacture of hermetically-sealed compressors and systems with the Universal Cooler Company. Prior to this, manufacture was mainly centred at the Crown Iron Works in Glasgow but in 1947 an entirely new factory with its own administration and sales organization was opened on the Hillington Industrial Estate to handle the smaller equipment.

Subsequently, when the Universal Cooler Company was absorbed by Tecumseh Products, who are the largest manufacturers of hermetic compressors in the world, a fresh agreement was made and the Hillington organization developed into the present hermetic unit division of L. Sterne & Co. A complete range is currently available from this division of hermetically-sealed units to Tecumseh designs from 1/12th to 2 h.p.

U.D. ENGINEERING CO. LTD.

AS is the case with practically every large company to-day, U.D. Engineering Co. Ltd. was originally a family business which was founded on the inventiveness and capabilities of one individual.

It was before the turn of the century that the late Mr. A. G. Enock founded his company, and it was during the reign of King Edward VII that, with the growing need for refrigeration, the business grew and that the slow-speed, vertical, single-acting, totally enclosed compressor with patented safety lifting head was developed and the range of machines increased.

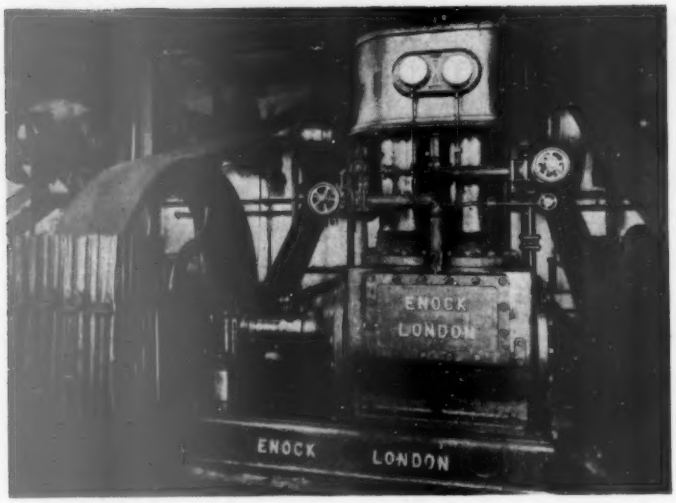
These old slow-speed compressors were built in sizes ranging from half-ton capacity up to 100 tons and ran at speeds from 90 to 200 r.p.m. and were in general use up to the early 30s.

The machines were not inefficient even by modern-day standards, as it is a fact that a large proportion of refrigeration compressors built to-day still incorporate the same type of valve gear.

In 1933 A. G. Enock & Co. Ltd. was incorporated into U.D. Engineering Co. Ltd., and this development made possible many improvements due to the increased possibilities for development and research.

High-speed compressors were introduced at this time and multi-stage and other special machines were designed to meet the exacting requirements of the industries which depended upon industrial refrigeration.

The research and development during the era preceding 1939 were responsible for the introduction and application of hermetic self-acting liquid ammonia pumps as well as what in those days were advanced designs in evaporators and condensers.



An early slow-speed compressor installed in an ice making factory.

During the war, whilst other activities of the company were restricted, the refrigeration division, under the management of Mr. I. Adamson, was able to expand, and many important contracts were undertaken and successfully fulfilled which directly contributed to the war effort of the country.

Rather naturally following the experience of the war years, when of necessity development work was intensified to meet urgent needs, considerable developments were possible in refrigerating plants for industrial purposes.

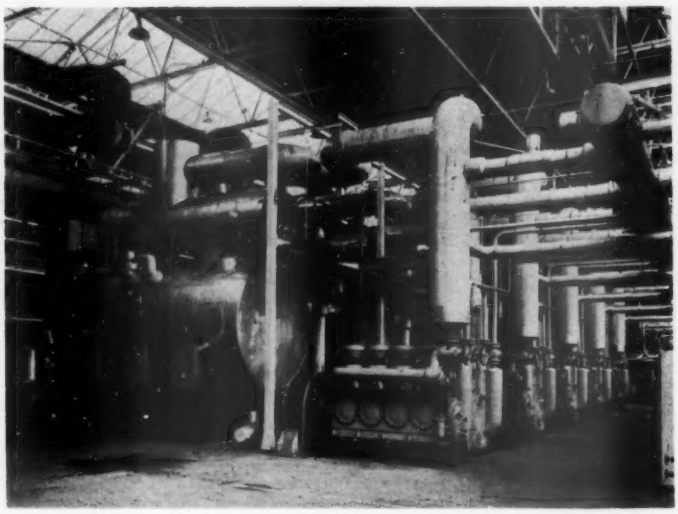
In the field of compressor design important advances were made in development of manually operated and automatic capacity control gear which provided for an over-all increase in refrigerating efficiency and power economy with fluctuating refrigerating loads.

In recent years " UDEC " has taken up a leading position in the design, manufacture, and installation of large-scale refrigeration for many industries both at home and abroad. Among the numerous specialized applications of " UDEC " refrigeration plant in post-war years are the new liquefaction plants installed at three factories of the Distillers Co. Ltd. at London, Manchester and in Scotland.

These plants were installed to meet the increased demand for Cardice and oil-free, liquid carbon dioxide under pressure which modern processes demand.

One of these processes is in an atomic power station where CO_2 is used as a heat exchange medium, and this particular application necessitates the use of perfectly pure CO_2 to prevent it becoming radio-active.

Many important installations have been undertaken over-



A UDEC installation in an atomic power plant.

seas, and among these were two 50-ton ice-making plants which were installed in Iran. These " UDEC "-built ice plants were modern counterparts of others installed in many parts of the world which provide for the production of high high-quality clear ice for domestic and clinical purposes, and opaque ice for industrial use.

It would take a long time to describe the multitude and variety of industries that are relying on " UDEC " equipment to-day. A short list would include breweries, dairies, abattoirs, meat cold stores, air-conditioning and quick-freezing, food processing, production of fine chemicals, the making of plastics, research laboratories, and oil refineries.

Here then in a few words is a description of the inception and growth of " UDEC " refrigeration in the past half century.

During this time the works have been extended many times and the floor space of the factory group now controlled by U.D. Engineering Co. amounts to approximately 120,000 sq. ft.

This, of course, is not the end of the story as developments will continue to go forward and U.D. Engineering Co. Ltd. is proud of the position of honour that it occupies in the industrial life of the country.

YORK SHIPLEY LTD.

IN keeping with several other organizations, York has seen many changes and as an example of development we mention five major steps which have taken place on industrial compressor design.

Fig. 1 illustrates the " A " frame compressor, in wide use in America until the turn of the century, although it was little used in this country. In order to counteract the considerable head room necessary for this type of machine, the horizontal double-acting compressor was produced, but there was little development of this type of machine beyond 1912.

There was a return to the vertical compressor, but in the enclosed form and demanding much-reduced floor area and height than its predecessor. This machine came into general use about 1915, although earlier models were in operation prior to this date ; in its early life the crankcase and cylinder block were a single casting.

Many improvements in valve design, bearings, lubrication and glands took place throughout the years, permitting higher speeds and there has always been a chase for greater output with lower space and weight requirements.

These problems were largely solved when York developed the high-speed multi-cylinder machine. Development of this unit in the early 30s incorporated those features which the design engineer had sought for many years and was a tremendous step forward in the history of our industry.

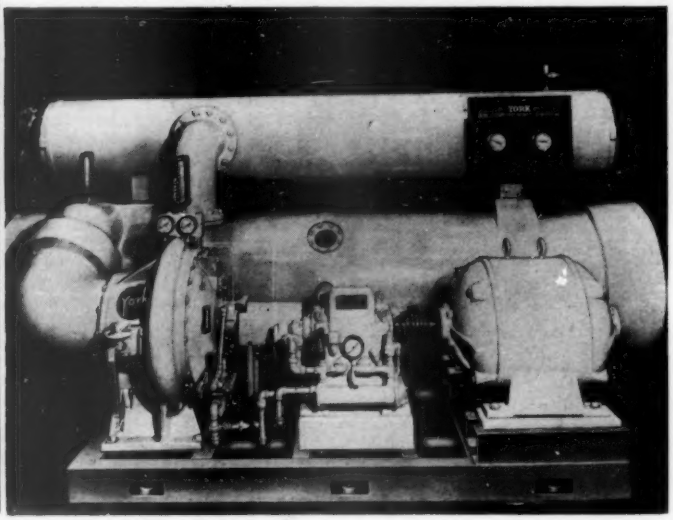
Research and development continued throughout the years, particularly along the lines of centrifugal compressors and extruded finned tubes for use in heat exchangers. Although several types of centrifugal machines have been developed and are in use, including the multi-stage pattern, York has developed the single-stage centrifugal system incorporating these new heat exchangers with machine speeds of more than 10,000 r.p.m. Fig. 2 illustrates such an assembly as now manufactured in U.K. Of course, capacity to weight and space ratios are very much in advance of any previous design of equipment and one is left wondering what the next step in this atomic age will be as far as refrigerating compressor design is concerned.

In the old days, ammonia was almost exclusively employed as the refrigerant, but here again, much work has been undertaken to develop other media. The tendency therefore has been to develop plant which permits the use of two or more refrigerants and York has achieved this with satisfactory results.

Of course, in a limited article like this it is only possible to touch briefly on a single aspect of York's manifold activity, but much work has gone on, particularly in the last quarter of a century on the small " Freon " machines and in the lower h.p. range we are seeing a gradual disappearance of the orthodox open-type compressor in favour of the hermetically sealed unit.

An early York installation.

Latest York "centrifugal"



Denmark

From A/S ATLAS

THE ATLAS refrigeration department, K II, comprises the production and sale of compressors, domestic refrigerators, home freezers, and commercial plants as well as special plants for research within the food industry, medicine, and various kinds of laboratories.

Domestic refrigerators are manufactured in mass production in sizes from 75 to 225 litres, and home freezers in sizes from 150 to 300 litres. Commercial plants comprise a mass production of large refrigerators up to 1,560 litres, refrigerated counters such as " single-decker," " double-decker," " multi-decker," and display cabinets of various designs and sizes, every kind of refrigeration plants for butchers, greengrocers, bakers, etc. and further, locker-plants, of which a very great amount have been delivered in Denmark and Sweden. Of special plants, we can mention the following which we made : Air-conditioned cooling- and freezing-rooms for the Research Institute of the Slaughterhouses at Roskilde, hypothermy units, units for cooling of patients' blood, low-temperature plants for various testings of material, crystals, etc. within the military, and special plant for the cyclotron at Prof. Bohr's Institute.

Honing of cylinders at Atlas.

Atlas commercial " Freon " compressors comprise five open types from 300 kcal/h up to 14,000 kcal/h. The compressor is a normal piston compressor with crank mechanism. A range of F-type compressors covers the range from 450 to 710 r.p.m. In 1958 an R-type compressor, running 1,000 r.p.m. was introduced. Further production includes two semi-hermetic types (Atlametic) from 1,000 kcal/h up to 2,000 kcal/h. All compressors are splash lubricated.

Production is based on batches of 1,000 units or more. Both the operation of working machines, the erection and testing of the compressors are performed by specialist workers, and the erectors of the machines are skilled workmen. A supervision department, independent of the production section, controls quality. In an ordinary open compressor the castings are 80 to 90 per cent. of the total weight of the compressor. Therefore, absolute uniformity of the castings, concerning machinability and accuracy of measurement, is of vital importance for mass production. The cast iron used is Meehanite. Therefore all castings are rigorously supervised as to Brinell hardness and accuracy of measurement, for certain elements it is a question of a 100 per cent. control. The tolerance zone of hardness ranges from 180–220 with exception of crankshafts which are also cast.

The most important stages of the block production are drilling and reaming of localization holes, milling of bottom flange, top flange and stuffing box housing flange in continuous milling machine, rough boring and fine boring of cylinders, boring for bearing lining, drilling and screwcutting of holes. This process is followed by pressure testing with 20 atm. air in a water bath. The last finishing operation comprises honing of cylinders as shown in fig. 1. The cylinders (and the pistons) are divided into six diameter groups by means of a Solex measuring instrument, ensuring, for instance, for the two smallest compressor types a clearance of 1/100 mm. between cylinder and piston. Then the blocks—and, by the way, this applies to all castings—are placed for 12 hours in a solar oil bath, in order that possible impurities may thus be dissolved. The last process in the finishing workshop is degreasing. The main bearing journals of the crankshafts are turned on a G F. copying lathe. The connecting rod journals are rough-ground, and the main bearing journals and connecting rod journals are fineground. Fine-grinding of the main bearing journals takes place on a centreless grinding machine. The surface roughness of journals is kept within 15μ in RMS. Connecting rods are fine-bored on a Heald fine-boring machine and finished on a Sunnen honing machine. Pistons are turned on an automatic machine and finished on a centreless grinding machine, where a surface roughness of 15μ in RMS is obtained. Valve plates are ground, bored and lapped to a surface roughness of 5μ in RMS.

Assembly begins with the fitting of crankshaft, connecting rods, pistons and stuffing box. Then the compressor is run-in for 20 minutes with oil flushing of the crankcase, where the oil is circulating in a circulatory system comprising a centrifuge for purifying of the oil. Valves are mounted under control of clearance space by means of a dial micrometer. For packings of different thickness under the valve plate, the clearance space is kept within 3 per cent.

The ready-mounted compressor is tested to pressure with 20 atm. air in a water bath. The control of the working capability of the compressor is tried out on a testing stand. The testing stand comprises five testing tables, and the testing time for a compressor lasts for 20 minutes. The testing stand contains a closed circuit with dry air. In the delivery pipe from each table a measuring nozzle is inserted, over which the pressure drop is registered by means of a mercury manometer. The suction pressure of the com-

Latest plant of A/S Atlas near Copenhagen.

pressor amounts to 0 atm., whereas the top pressure may be maintained at 6 or 9 atm. by means of constant pressure valves. By means of solenoid valves a change-over is ensured between the two top pressures. The mercury column indicates the capacity, which is thus registered for the two compression ratios. On the testing stand the tightness of pressure valves is controlled. For the smaller types—with closed stop valves—it is required that the pressure does not drop more than 5 kg/cm² in 3 minutes, whereas the limit for the 3 big types is 5 kg/cm² in 1·5 minutes. The demand for vacuum is at least 50 cm. Hg. at a top pressure of 9 atm. After having been lacquered, the compressors are dried by blowing-through of dry air (dew point–40°C.) at 120°C. for 3 hours. The final test is a leakage test for "Freon" with a "General Electric" leak detector type H-1. This detector has 3 fields of sensibility (H-M-L). Within the H-field it is possible to detect escapes, if the leakage is 0,28 g per year. Joints on screwed caps or packings are only approved, if no fluctuations are registered within the H-field. The demands on the tightness of the stuffing box have from experience been fixed at a maximum of 5 within the M-field. From this stage, the compressor is passed on for being filled up with oil, after which it is ready for dispatch.

* * *

THOMAS THS. SABROE

THOMAS Ths. Sabroe & Co. Ltd., Aarhus, were established in 1897. During the past 60 years they have influenced appreciably the development of the refrigeration in Denmark as well as in many other countries.

The establishment of the company took place even at the time when the mechanical refrigeration commenced to appear in other countries, and the company soon understood that the refrigerating machine could become of great importance to the manufacture, conservation and transport of food.

After the change of the Danish agriculture from grain production into dairy produce and slaughterhouse produce there were favourable conditions for introducing the refrigerating machine into the Danish agriculture.

However, even with these favourable conditions it was not easy to introduce mechanical refrigeration into the dairies which had been quite satisfied with the natural ice for many decades. Much propaganda had to be made, but already in 1898 Sabroe succeeded in selling the first CO_2 compressor to a Danish co-operative dairy. In the same year a competition was held between three Danish types of refrigerating machines with, respectively, carbonic acid, ammonia and sulphur dioxide as refrigerants. Sabroe participated with a CO_2 plant, and this system won.

The result of the competition, which had come into existence on the initiative of the Danish dairy organizations, was, of course, that the dairies came down in favour of Sabroe's manufacture, and in the coming decades Sabroe delivered so great a number of CO_2 refrigerating plants to the Danish dairies that at one time 75 per cent. of all the dairies in Denmark were equipped with Sabroe refrigerating plants.

This wide acceptance of the Sabroe CO_2 machine in the Danish dairies soon caused foreign users to take an interest in these plants, and before long exportation had started. This exportation has held through the years, and has occupied from 50 to 75 per cent. of the total manufacture.

The refrigerating machines at first gained a footing in the dairies ; however, when other industries became aware of the advantages of the mechanical refrigeration in preference to the natural ice it was not long before Sabroe obtained orders from chocolate factories, breweries and ice factories.

The exportation rapidly spread from European countries to overseas countries all over the world.

The Sabroe refrigerating machines were used not only on land ; with the large exportation of food to England it was not long before the shipping business, too, got interested in mechanical refrigeration.

In 1902 Sabroe installed their first ship's refrigerating plant in the butter export ship s.s. *Frejr*. This plant was the first one of a great number of ship's refrigerating plants which Sabroe have delivered to a very great number of shipowners.

Through the years, ships' refrigeration has undergone very considerable development both as to the machinery and as to the goods to be cooled.

At the beginning the demand was for refrigerated ships for transport of butter, bacon, eggs and meat, and later on of reefers, freezing ships, ships for transport of fish and factory ships.

(*Continued on page* 414)

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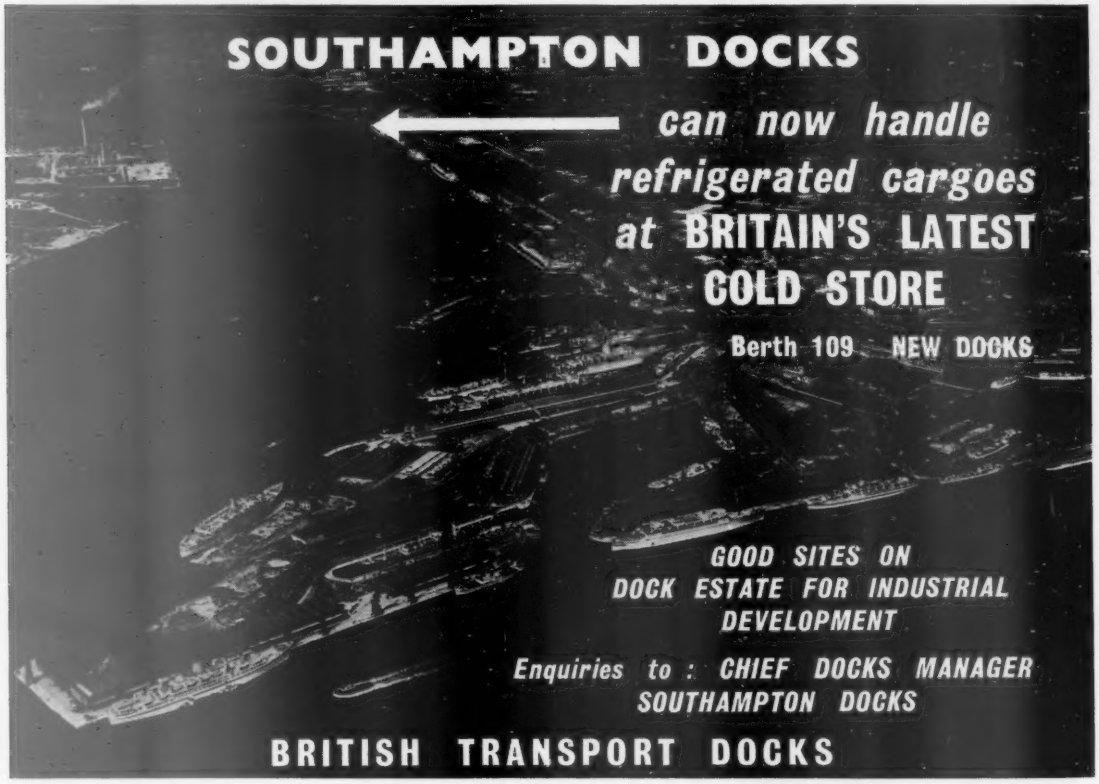


Air-conditioning a "Must" for Hotels

Climate Control in All Guest Rooms

From Our New York Correspondent

"IT'S easier to sell a $25 suite with air-conditioning than a $7.50 single without air-conditioning," said an American manager recently. This is not an individual remark, but it shows the trend of present and future development. Air-conditioning has become a "must" for hotels, motels and restaurants. Charles Grutzner, in a survey of New York hotels, has called the current year "the year of air-conditioning" and well he may do so. Of $30,000,000 being spent for quick modernization among the 170 hostelries of the "Hotel Association of New York City," more is going for air-conditioning and room television than for any other item. In the last three years, the better hotels have begun conversion to *central* air-conditioning.

Billion-Dollar Future for Air-conditioning

The production of major air-conditioning and refrigerating units will become a billion-dollar-a-year-industry within a decade. This is the prediction of Charles V. Fenn, vice-president of Carrier Corp.'s machinery and system division. Over-all industry volume for the large equipment (100 tons or more) was about $600-million in 1957, and for 1965 a volume of $1.3-billion is expected.

Biggest potential over the long haul, says Mr. Fenn, is industrial air-conditioning. He thinks that saturation of the market in this area is "probably less than one per cent." At present the biggest market is in existing office buildings. Next biggest market is shopping centres and department stores. Also high on the list are apartment houses, hospitals and hotels; they have an estimated potential of $500-million.

Why Air-conditioning in Hotels ?

The need for air-conditioning in the hotels of the South is self-explanatory, and all better hotels in the South of the United States are already converted to air-conditioning, and even many of the "less better" hotels. But why has New York, with its partly hot-humid but not-too-long summer, such an outburst of installing air-conditioning equipment?

New York at present needs more conversion to air-conditioning first because the new Coliseum, largest exhibition hall in the world, is drawing millions of visitors to the city. Furthermore, no major new hotel has been built in New York in the last 25 years.

More Production

Air-conditioning in hotels, of course, is necessary in the first place for the guests. But as in many industries, air-conditioning is not only meant to provide comfortable conditions for people living in those rooms—production control is frequently an important consideration.

Hotel employees can work better and produce more in air-conditioned surroundings. A recent engineering survey of 75 industrial enterprises has shown that air-conditioning has paid off. In the average uncooled establishment, each employee lost the equivalent of $108 a year in wages, the reason being that hot, humid weather had caused personnel to slow down or even to stop working altogether. By contrast, air-conditioned employees and workers got the job done on time, took shorter lunch hours and even hung around after the 5 o'clock whistle had blown.

The major hotels in New York hope to have their houses completely air-conditioned by the end of this year. Conversion usually is done in stages because rooms cannot be used while the conversion is going on. Four-hundred of the Waldorf-Astoria hotel's 2,000 rooms were air-conditioned before 1956. Four-hundred-and-fifty more have been transformed in 1956, and another 400 were converted in 1957. The air-con-

ditioning and current change are costing $500,000. Still hotels, in general, are not putting an extra charge on air-conditioned rooms. Rooms which formerly have been regarded as the least desirable, are well asked for after conversion to air-conditioning. Charles Grutzner mentions that guests who used to spurn inner courtyard rooms, are now preferring them, air-conditioned, to outer rooms with no air-conditioning or with the old type of window box air-conditioner.

Depressing Employees' Morale

Employees' ability to work drops noticeably if air conditions rise above 80° F. ET (effective temperature). In the hotel industry chefs and cooks are better trained to stand the heat than are waiters or room clerks. High temperature combined with high humidity depress employees' morale.

Life magazine recently had an extensive report on exact experiments connected with the efficiency of air-conditioning. 15 suggestions were made by air-conditioning engineers for the efficient operation of a cooling unit. Of these, the following are of particular interest to air-conditioning in hotels and restaurants. A unit too small will not do the job, but one that is too big, will result in poor humidity control. The air in the rooms should move constantly. The units should be set to bring in some fresh air from out of doors. Ducts that carry air from a central unit should be insulated wherever they pass through uncooled space. The air-conditioner should be so constructed that no water stays on the cooling coils when the machine stops, or so that the air bypasses the coil completely. Otherwise excessive humidity results.

Changed Trend

The hotel industry in New York for quite a few years has generally followed the practice of installing individual window cooling units to bolster the sagging summer business during the past few years. Hotels have been reluctant, according to Charles G. Taylor, president of the St. Moritz Hotel, to install central systems because of the comparatively short period of extreme heat during the summer.

The new trend, however, is to all-year air-conditioning. Long established in theatres, movie houses and department stores, it is growing more popular in hotels, offices and homes. The St. Moritz is just an example of the changed trend. For years it had individual air-conditioning in some rooms. Last year, however, it began central installation in its $750,000 programme to have each of its 1,000 rooms air-conditioned within one year. Another example: The Plaza Hotel, with 450 of its 1,000 rooms now tied to central air-conditioning, will complete installation this year.

Installation of central air-conditioning is a complex and costly operation, and the reluctance of many hotels can well be understood. It often requires shifting of power cables and other underground networks. Changes must be made in the layout of the hotels to accommodate the huge cooling and washing machines, beside the fact that rooms are out of service while the changes are being made.

Successful Air Conditioning

There is no doubt that living and working in properly air-conditioned hotels, offices, restaurants and homes is a decisive step forward in comfort efficiency and health. Hotels which have no air-conditioning cannot compete any longer with hotels which have such installations, whatever their other merits may be.

The secret of life with successful air-conditioning, says Dr. Miller, is not to overcool a room, and to teach your body how to adjust to the transition from an air-conditioned room to humid, hot weather outdoors. To make this adjustment, you have to begin to perspire vigorously again.

The problem of the possible favourable influence of air-conditioning upon the incidence of respiratory illness has not yet been answered clearly, and yet it is important with regard to absenteeism in the hotel industry. Some scientific observers have reported considerable reduction in the illness rate through air-conditioning. There is no doubt that for weak hearts or diseased arteries, air-conditioning means better health and longer life.

In the annual review of Hoover Ltd. for the year to December 31, 1957, it is stated in part: "The past year has been marked by many difficulties, not only at home but in most of our markets overseas. At home there has been a further intensification of the drive against inflation, with even sterner measures to restrict expansion of credit. In the earlier part of the year petrol rationing adversely affected transport costs and a nation-wide strike in March increased our difficulties. In spite of all these difficulties, to which we have now become accustomed, we have had a most successful year. The turnover of our British companies has increased by 13 per cent. In our overall organisation we now employ 16,500 people, of whom nearly 5,000 are employed in our subsidiary companies overseas."

Proposals for A New and Simple Numerical Designation of Hydrocarbon Derivatives Containing Fluorine and Used as Refrigerants

THE American Society of Refrigerating Engineers (A.S.R.E.) has fixed in " Standard 34 " the numerical designation for fluorated hydrocarbons and for all other refrigerants.†

These proposals were thoroughly discussed in a sub-commission of Commission 3 of the International Institute of Refrigeration (President Professor P. Glansdorff, Belgium) on July 27, 1957, at Karlsruhe by a group of representatives of the leading European chemical works engaged in the manufacture of fluorinated refrigerants (France, Germany, Great Britain, Holland and Italy). It was found that a numerical designation should be extended on fluorinated refrigerants only and that the system proposed by A.S.R.E.-Standard 34 can be much simplified and made easier to retain. The new proposals have been discussed on September 13, 1957, at a meeting of Commission 9 of I.I.R. at Wageningen (Holland). There was no objection.

These proposals, reproduced below, were transmitted to the A.S.R.E. on November 10, 1957.

Comments from readers are asked for.

The general chemical formula of a halogenated hydrocarbon refrigerant containing fluorine, chlorine and bromine atoms is :—

$$C_m H_n F_p Cl_q Br_r.$$

Iodine is not to be taken into consideration.

1. It is proposed to write the halogen constituents behind C and H in the order of the atomic weights, that means first F, next Cl, last Br. This is the practice adopted in most European countries, while in the United States two orders are used :—

(*a*) The alphabetic order (Br)-Cl-F ;

(*b*) The order of atomic weights F-Cl-Br.

Scientific journals prefer the order (*b*), technical magazines use both and sometimes make no distinction (see the paper of F. J. Norton in *Refrigerating Engineering*, September, 1957, page 33 : C H Cl F_2 and C F_2 Cl_2). The order (*b*) has a deeper scientific background and has the advantage that the proposed system of numbering becomes simpler if Br is put on the last place, because in most cases the number of Br atoms is zero and can be omitted.

2. With very few exceptions, derivatives of *saturated* hydrocarbons only are used as refrigerants. In all such cases there is a definite relation between the coefficients m, n, p, q and r which can be written in the form

$$2m + 2 = n + p + q + r.$$

Therefore one of these coefficients can be omitted in the number designating a certain compound. It is proposed to omit n, while Kinetic Chemicals omit q.

† See *Refrig. Engineering*, Vol. 65, No. 2, Feb., 1957, page 49.

* " Halogenated Extinguishing Agents," by R. C. Downing and B. J. Eiseman, Jun., Jackson Laboratory, E. I. du Pont de Nemours & Co. *N.E.P.A. Quarterly*, October, 1951.

For other halogenated hydrocarbon refrigerants, such as derivatives of non-saturated compounds (olefins), cyclic compounds and azeotropic mixtures, a prefix is proposed, such as C for *c*yclic compounds, N for *n*on-saturated and A for *az*eotropes.

3. The system of numbering proposed in A.S.R.E. Standard 34 is

$$(m - 1)\ (n + 1)\ p.$$

Here q is omitted.

Example : C F_2 Cl_2 has the number 012, whereby zero in the first digit is omitted.

This system seems to be unnecessarily complicated ; there is no reason to put (m − 1) instead of m or (n + 1) instead of n ! Furthermore, this system does not permit to consider bromine atoms in a simple way. Therefore the artificial construction was introduced to mention the number of bromine atoms at the end of the total number. Thus C F_3 Br becomes 1 3 B 1.

4. Another American numbering system—that adopted by the National Fire Protection Association (N.F.P.A., Q 48–8)—is much simpler and easier to remember*). It is used for the so-called " Halon " agents and permits a convenient and quick reference to the numerous chemical compounds : in this system the first digit of the number represents the number of carbon atoms in the molecule ; the second digit, the number of fluorine atoms ; the third digit, the number of chlorine atoms ; the fourth digit the number of bromine atoms. Terminal zero digits are not expressed. Thus the number is simply m p q r.

Examples :	C F_2 Cl_2	:	122
	C F_3 Cl	:	131
	C H F_2 Cl	:	121
	C_2 F_4 Cl_2	:	242
	C F_3 Br	:	1301
	C_2 F_3 Cl_3	:	233

5. A sub-commission consisting of representatives of European chemical factories producing fluorinated hydrocarbon refrigerants and of members of Commission 3 of the International Institute of Refrigeration held a meeting in Karlsruhe July 27, 1957. At this meeting the following persons were present :—

Professor Glansdorff, University of Brussels, president of Commission 3, I.I.R.
Professor Kuprianoff, president of Commission 4, I.I.R.
Professor Nesselmann, vice-president of Commission 6, I.I.R.
Professor Plank, vice-president of the executive committee, I.I.R.
Professor Vahl, vice-president of Commission 3, I.I.R.
M. Roblin, Societe Electrochimique d'Ugine at Lyons (France).
Dr. Rowell, Imperial Chemical Industries Ltd., Liverpool (Great Britain).
Dr. Scherer, Farbwerke Hoechst, Frankfurt (German Federal Republic).
Dr. von Schweinichen, S.A. Montecatini, Milan (Italy).
Dr. Steinle, Robert Bosch G.m.b.H., Stuttgart (German Federal Republic).

After a detailed discussion this sub-commission decided unanimously in principle to recommend the " Halon "-numbering system

m p q r

for international consideration.

6. The proposed " Halon " numbering system is to be completed as follows :—

(*a*) The prefixes C, N and A are to be added for cyclic compound, non-saturated (olefin) compound and for azeotropes, as indicated in paragraph 2.

Examples : Octafluorcyclobutane C_4F_8 : C 48
Vinyl chloride, $CH_2 = CHCl$: N 201
Vinyl fluoride, $CH_2 = CHF$: N 21
Dichloroethylene, $CHCl = CHCl$: N 202
Carrene 7, an azeotropic mixture of CF_2Cl_2 and $CH_3 . CHF_2$: A 122/22a.

(*b*) In the case of isomers, each has the same number and the most symmetrical one is indicated by the number without any letter following it. As the isomers become more and more unsymmetrical, the letters a , b , c ... are appended. (This is as well as the proposal made in the A.S.R.E. Standard 34, point 2.2.7).

Examples : $CFCl_2 . CFCl_2$: 224
$CF_2Cl . CCl_3$: 224a
$CF_2Cl . CF_2Cl$: 242
$CF_3 . CFCl_2$: 242a
$CH_2F . CH_2F$: 22
$CH_3 . CHF_2$: 22a
$CH_2Cl . CHF_2$: 221
$CH_2F . CHFCl$: 221a
$CH_3 . CF_2Cl$: 221b

(*c*) If the number of certain atoms in the compound is higher than 9, this number is to be taken in brackets.
Example : C_4F_{10} : 4 (10).

7. The proposed designations for halogenated hydrocarbon refrigerants present the following advantages :—

(*a*) Bromine atoms in a compound can be represented in the same way as fluorine and chlorine atoms (which is not possible in the A.S.R.E. Standard 34).

(*b*) As bromine has the highest atomic weight its corresponding digit stays at the end of the number and can always be omitted if there are no bromine atoms.

(*c*) The order m p q r is simpler and easier to remember than the order (m − 1) (n + 1) p B x proposed in the A.S.R.E. Standard 34. It gives a true picture of the composition of the molecule.

(*d*) Digits and letters are clearly distinguished, digits representing the numbers of different atoms, and letters characterizing the molecular structure.

(*e*) The capitals C, N, A have an international significance.

(*f*) The proposed numbering system is not new ; it is already used in the United States for designating the fire extinguishers.

Therefore it is hoped that the proposed system of designation will be accepted by the A.S.R.E. Standards Committee.

8. The representatives of the European countries mentioned in paragraph 5 do not feel any necessity to number other customary refrigerants, such as ammonia, sulphur dioxide, carbon dioxide, water, air, etc.

R. PLANK.

GOODS DAMAGED ON ARRIVAL

WHO IS RESPONSIBLE ?

By LORD MESTON

FEW things are more annoying than to receive a parcel of goods which is in a damaged condition. There is no good " letting off steam " at the postman or the man driving the van who has brought the goods to your house. They are merely the passive agents of a higher authority. Before deciding to complain, let us see what is the position with regard to the damage of goods in transit.

Where A buys goods from B, and B sends them by carrier to A, the buyer should make it clear to the seller how he wishes the goods to be forwarded—whether at the owner's risk or the carrier's risk. As we shall see later, there is a considerable difference between these two risks. Thus, where goods are consigned at " owner's risk," in order to succeed in a claim against a carrier it may be necessary to prove that there has been wilful misconduct on the part of the carrier. This entails a much higher burden of proof than in the case of goods being consigned at " carrier's risk."

Is one justified in refusing to accept goods which have been badly damaged in transit ? The answer to that question depends upon the conditions of the contract between the buyer and the seller, and what arrangement the latter has made with the railway carrier to convey the goods to their destination.

Where goods are purchased on " carriage paid " terms, and forwarded on either the owner's risk or the carrier's risk, the liability remains with the seller until the consignment is actually delivered into the buyer's possession. If the goods are found to be damaged on delivery, the buyer merely has to tell the railway carriers of the condition of the goods and leave it to the seller to claim on the carriers for the damage done.

On the other hand, where goods are bought " free on rail " the responsibility for what happens during the transit rests with the buyer. The seller has no further responsibility after he has handed the goods to the railway carrier.

When goods are purchased and sent by carrier to the buyer, in whom is the property (*i.e.*, the legal ownership) of the goods vested ? This is an important question as it naturally affects the subject of insurance. The general rule is that when goods are delivered by the seller to a carrier to be forwarded to the buyer, the property in the goods rests immediately in the buyer, and he is therefore the proper party to sue the carrier for the loss or non-delivery of the goods, or for any injury done to them, although the carriage may have been paid by the seller and the buyer gave no particular directions as to the carrier by whom the goods were to be forwarded to him.

When goods are dispatched " on sale or return " different considerations arise. In that event the property in the goods remains in the seller until the buyer does some act " adopting the transaction " (e.g. paying for the goods) or keeps the

goods for such a long time that the presumption is that he (the buyer) intends to keep the goods and pay for them. If the goods are damaged in transit from the seller to the (prospective) buyer, then the property in the goods is still in the seller and he is the person to make any claim on the carrier for loss, non-delivery, or damage to the goods in transit. Similarly, if the (prospective) buyer decides within a reasonable time not to buy the goods and returns them, the property in the goods still remains in the seller and he is the party to claim on the carrier for loss, non-delivery, or damage to the goods in transit while they are being returned to the seller.

All merchandise carried by a railway without any special contract is carried at the *carrier's risk conditions*. In order to bring the " owner's risk " conditions into operation (to which we will refer later) a request in writing to carry at the rate applicable to owner's risk is necessary, and the request is only effective if an owner's risk rate is in operation for the particular goods.

Before dealing with " carrier's risk conditions " it is necessary to refer to the position of a common carrier at common law.

A common carrier is an insurer of the goods which he contracts to carry, and is liable for all loss of, or injury to, those goods while they are in course of transport, unless such loss or injury is caused by the act of God, or by the Queen's enemies, or is the consequence of inherent vice in the thing carried, or is attributable to the consignor's own fault. The liability of the common carrier is always an absolute one. Thus, he may be liable for loss or damage even where he has taken every reasonable precaution. Railway companies (through their successor, the Transport Commission) are common carriers of goods by rail. The transfer of the railways from private to public enterprise has not affected the legal position of the carrier by rail towards actual or potential customers.

The extent to which carriers by rail can be called common carriers has been the subject of argument in the past but is no longer the ground of any possible difference of opinion. For, so far as railways are concerned, the common law rule as to the liability of common carriers has been largely superseded by statute. In this connexion " standard terms and conditions " are a codification of the railway carrier's liability at common law with certain important changes.

At " carrier's risk " the Transport Commission undertakes the " common carrier's " absolute liability. The owner whose goods have been carried by carrier's risk and are either lost or damaged during transit need not prove anything but that they were so lost or damaged, and that he, in consequence, suffered pecuniary loss. His right to compensation does not depend upon proving negligence on the part of the carrier's servants.

It is only in the case of the *excepted perils* that the Transport Commission will be free from liability ; and even then it is for the Commission to prove that all reasonable foresight and care in the carriage of the merchandise was used. That is to say, in the case of the excepted perils, the Commission has merely to prove that there was no negligence on their part.

The four excepted perils under the " standard terms and conditions " are as follows :—

1. *Act of God.* The carrier is not liable for any accident as to which the carrier can show that it is due to natural causes directly or exclusively, without human intervention, and that it could not have been prevented by any amount of foresight and pains and care to be expected from the carrier. Thus, rain and frost are forces of nature which may do much harm to certain classes of goods, but they constantly occur and must be foreseen and guarded against by the carrier. It is only against the extraordinary forces that the carrier is not bound to take precautions, as, for example, lightning ; and extraordinary storms or falls of snow may come within that category.

2. *Act of war or of the Queen's enemies ; and restrictions by Government, and labour disputes.* The carrier is not liable where loss or injury is caused by the Queen's enemies. The expression " the Queen's enemies " does not include rebels or robbers or rioters ; it means the armed forces of a foreign power with which the country is at war. For example, if goods in transit on a railway are damaged by bombs from hostile aircraft the railway carrier is not liable for the value of the goods. A number of types of interference by Governments and their agents in peace as well as in wartime, and disturbances caused by outsiders, have also been made excepted perils. This comprises every interference on the part of a Government authority with the carriage of the goods such as may happen in case of a prohibition to consign goods of a particular description from an area infected by a contagious or epidemical disease. And the carrier is not in any case liable for riots, civil commotions, strikes, lock-outs, stoppage or restraint of labour from whatever cause, whether partial or general. In this connexion, the Transport Commission do not have to prove that they have used reasonable foresight and care to avoid riots and labour disputes.

3. *Inherent vice and deterioration.* In this connexion, " inherent vice " means some default or latent defect in the thing itself which by its development tends to the injury or destruction of the thing carried. Thus, a carrier is not liable for injury to fruit or other perishable goods from heating or natural decay during transit, provided the carrier has taken all reasonable care of the goods according to their nature, as, for instance, seeing that they have proper ventilation. And the carrier is not responsible for diminution of liquids caused by evaporation or leakage, which no ordinary and reasonable care on his part could prevent ; nor is the carrier responsible for destruction by spontaneous combustion.

4. *Consignor's or consignee's own fault.* For example, where goods are liable to injury in transit unless they are protected by packing, it is the duty of the consignor to pack them properly. Damage arising from neglect of this duty without any fault on the carrier's part is not damage for which the carrier is liable. Furthermore, the carrier is not liable for the consequences of insufficient or improper addressing, labelling and filling in of the consignment note.

Owner's Risk Conditions

As already stated, in order to bring the owner's risk conditions into operation a request in writing to carry at the rate applicable to owner's risk is necessary, and the request is only effective if an owner's risk rate is in operation for the particular goods.

At owner's risk the Transport Commission undertakes to compensate the owner for the consequence of the " wilful misconduct " of its own servants if the owner can prove it. Wilful misconduct must be distinguished from negligence. It means doing something, or omitting to do something, by a person who knows that his act or omission is wrong. This includes the doing of an act with reckless indifference, not caring what the result of the indifference may be. This attitude is something beyond negligence even of a gross kind. But the carrier is liable without proof of wilful misconduct if the whole of a consignment, which was properly packed and addressed, does not arrive at all. In such a case, however, the Transport Commission can avoid liability if the cause of the non-delivery was accident or fire. In those events the trader must prove that the accident or fire was due to the wilful misconduct of the carrier's servants. The Commission is also liable without proof of wilful misconduct in the case of pilferage from packages which were protected otherwise than by paper or other packing readily removable by hand.

Development of the Herring Industry

New Plants being set up in Scotland

SOME twelve years ago the Herring Industry Board embarked on a programme of re-equipment of the industry which sought to make good the years lost through war and the application of new ideas, including the introduction of storage and processing routines unknown when the board was first set up in 1935. The most important of these improvements has been the conversion of the herring fleet from old steam drifters to modern diesel-driven, dual purpose vessels and the introduction at suitable points of additional processing and storage facilities to handle the catch.

On the catching side, some 234 new vessels have been put into use under grant and aid schemes involving assistance in the region of £1½ millions. This does not take into account further aid which has been given for the purchase of new engines, nets and, on the processing side, for the laying down of plant and machinery.

The foregoing is in keeping with the duty imposed on the board to provide the finance and the responsibility has been very fully accepted and particularly so in the development of quick-freezing facilities. The current popularity and extended use of frozen foods may tend to cloud the fact that in the 'forties there was caution and even suspicion of quick-frozen foods. The herring industry in particular was far from enthusiastic and there were critics who contended that quick-freezing had no major rôle in their industry. The board thought otherwise and in 1946 they built the first commercial factory in the world devoted entirely to quick-freezing of herring and herring products. This factory was located at Lerwick and incorporated cold stores and a fully mechanized kippering plant, all of which have been invaluable to the industry over the past 12 years —and not only to the herring industry since the facilities laid down for the fishing industry have been utilized at various periods by other producers in the vicinity, including the Shetland lamb dealers.

A further plant was installed later at Stornoway which suffers from isolation from mainland facilities and is perhaps the best example of the importance of modern processing facilities as an aid to continuity of operation. This point has been made periodically by Stornoway kipperers who have indicated that, without these facilities, they might well have gone out of business.

It should be stressed that quick-freezing is only one of a variety of services and projects which the board initiated and was not, by itself, regarded as a solution to the problem of gluts which until the board tackled them were perhaps the most

Loading kiln with herrings for kippering at Lerwick.

troublesome aspect of the industry. To deal speedily with the spasmodically excessive landings of herring the board laid down reduction plants for the production of herring meal and oil at Wick, Stornoway, Peterhead, Peel and Great Yarmouth. Existing firms were encouraged to enlarge their own facilities and have been assisted in the setting up of factories, to the point where the only main fishing areas without at least one factory are the South Minch and the Clyde. Plans have been drawn up for the erection of a processing centre at Mallaig to cover the South Minch mainland area and this will, it is expected, include quick-freezing. Once again it is accepted that reduction to meal and oil is not in itself the whole answer to the problem of gluts; taken with quick-freezing, cold storage and other processing they do, however, constitute a very sound buffer which has helped to keep in operation fishings which would otherwise have ceased to exist.

Some idea of the magnitude of the board's operations can be seen from the fact that in the current winter fishing in the Minch more than a quarter of the landings are handled by meal and oil factories, all herring unwanted for other purposes. Last year about one fifth of the total catch was taken for reduction, the entire operation of which lies with the board.

Looking specifically at the quick-freezing activities of the board, attention might be given first of all to Lerwick. This original plant was established in 1946 and handles herring, kippers and white fish. The plant here has a capacity of 2¼ tons per hour and sub-zero storage for 600 tons of quick-frozen products. In the last summary of operations, an important aspect is the increased use made of the service by white fish interests; the tonnage processed on account of one large commercial concern was 65 per cent. greater than in 1955. This is an indication of the valuable part played by the board in providing facilities for others besides the herring industry, a service which allows optimum use of the plant to the advantage of the concerns using the facilities. The curtailment of the Shetland herring season in 1956 had a serious effect on the factory's throughput and this was particularly unfortunate since there were strong demands at home and abroad for quick-frozen herring.

The overall picture in this area can perhaps best be shown by a comparison of two years. This is as follows:—

	1955 STONES	1956 STONES
Quick-frozen herring	63,932	38,721
Quick-frozen kippers	14,010	192
White fish - - -	118,808	194,681

The Stornoway picture is equally interesting. In 1956 the board decided to increase their facilities devoted to quick-freezing and to reduce their chilling activities. In this case the overall picture was a 6 per cent. decrease on the throughput over

the previous 12 months, not due to any lack of interest in the quick-frozen product but to insufficiency of supplies in the early part of the season.

The figures for Stornoway are as follows:—

	1955 STONES	1956 STONES
Quick-frozen herring	280	903
Quick-frozen kippers	48,554	70,799
Chilled kippers - -	36,084	8,671
Chilled herring bait -	425	1,484

Here again the board co-operated fully with local interests in the processing of foodstuffs and in particular with Associated Stornoway Kipperers Limited for whom they handled 10,120 stones of quick-frozen kippers in 1955 and 14,881 stones in 1956. The 1958 picture is that a new cold store three times the size of the present one is about to be built and the quick-freezing capacity is to be increased by one third to cope with the growing demand. The decision to build a new processing centre at Mallaig has been indicated officially. This will be capable of handling an annual throughput in the region of 10,000 crans and will have adequate quick-freezing facilities to meet the needs of this area.

The importance of quick-freezing to the herring industry can be assessed from the fact that the total quantities of herring taken up for quick-freezing either as such or as kippers in 1956 was 49,402 crans or a 58 per cent. increase on the 1955 volume, a really remakable achievement when it is remembered that there was in this period a definite reduction in the total landings. This rate of increase was sustained in 1957. This confirms the policies of quick-freezers of expanding steadily their take of the total catch. It also confirms that quick-frozen herring and herring products are now firmly established as a desirable commodity for both home and export markets.

Looking to the future, the board takes this view of quick-freezing as applied to herring industry activity: "Inasmuch as the quality and conditions of herring vary seasonably, it is very clear that quick-freezing has an important part to play in the development of the industry. More and more herring caught and processed while in the prime of condition will be available for release to the markets, both at home and abroad, all the year round."

While this summary has necessarily concentrated on board activity a number of small developments have been carried through in Scotland by the herring trade to lay down their own facilities or to utilize commercial stores to that end. The work done in this latter sphere has been so satisfactory from the viewpoint of continuity of operation by allowing regularity of supplies of good quality even in periods of limited landings, that a few of these firms have now reached the

Part of the cold stores at Lerwick.

point where creation of their own reserve supplies has become a possible and promising move. The obvious handicap in such projects is the financial one and although a reasonable amount of discussion has been taking place the actual laying down of private storage space is likely to be a slow and cautious process. Which makes the more valuable the pioneering work done by the board since this work has undoubtedly been a factor in persuading individual firms of the merits of quick-freezing. The fact that the industry is veering round to such a personal policy is perhaps the most important aspect of the freezing picture in Scotland when one remembers the caution and even hostility which faced the initial proposals some 12 years ago to introduce this "new-fangled" process.

It is worth ending on the note that quick-frozen herrings are by no means an unimportant export. Among the countries now taking supplies from this country are Nigeria, South Africa, Rhodesia, Eire, Poland, Czechoslovakia, Eastern Germany and the U.S.A. and to a lesser extent Cyprus, Ghana, Kenya, Australia and New Zealand.

Domestic, Electrically-operated Refrigerators in Canada

AN IMPORTANT GOVERNMENT SURVEY

(*Continued from p. 227, March issue*)

Extent of the Market and Sources of Supply

(*a*) *General.*—Although winter temperatures drop well below zero in many parts of Canada, some form of refrigeration for food is considered to be essential, since nearly all houses have central heating.

(*b*) *Extent of the Market.*—Between 1953 and 1956 the number of homes increased by 333,000. This is a 9 per cent. increase on the previous total of 3,600,000. In the same period, electrification of rural areas progressed steadily, so that the number of homes with electric power has increased by 3 to 93 per cent. of the total.

Homes with mechanically operated refrigerators showed an even more significant increase from 67 to 80 per cent. of the total. The increase is accounted for almost equally by a reduction in the percentage of homes with ice boxes and of those with no form of refrigeration at all.

Sixty per cent. of Canadian households are located in the provinces of Ontario and Quebec. About 8 per cent. are located in each of the four western provinces (British Columbia, Alberta, Manitoba and Saskatchewan) and the remaining 8 per cent. in the four Maritime provinces taken together (Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick).

(*c*) *Canadian Production.*—There are over a dozen Canadian manufacturers of domestic refrigerators, but there is no regular production of models with a capacity of less than 8 c.ft. The most important firms are either subsidiaries of United States manufacturers or manufacture under licence from United States companies. According to a recently conducted survey, the most popular makes in Canada are "Frigidaire," "Canadian General Electric" and "Westinghouse."

In 1956 more units were manufactured than ever before. However, production is subject to severe cutback from time to time on account of stock accumulations and there is no doubt that the industry can more than keep pace with the expanding demand.

(*d*) *Imports.*—Canada imports roughly half as many units of 8 c.ft. and upward as are produced by Canadian manufacturers. Probably the bulk of these imports are made by the large Canadian department and mail order stores, who have exclusive arrangements with United States manufacturers for the production of special brand models. While the brand name is exclusive, the same model is supplied under other brand names to seven or eight United States department and mail order stores, whose selling areas do not clash. Thus, by using United States manufacturers, the Canadian stores obtain the cost benefits of mass production on a scale impossible in Canada itself. Some small units, 4 c.ft. capacity or less, are imported from the United Kingdom.

(*e*) *Exports.*—Although Canada's exports of mechanical refrigerators vary considerably from year to year and are influenced by import restrictions in overseas countries, the business has always been small. In 1956, it amounted to $398,000, the chief customers being the Union of South Africa and the British West Indies.

Nature of Demand

The primary demand in the Canadian market is for

refrigerators to be used in the kitchens of homes as a means of food storage and the tendency of recent years has been towards larger capacity models. The 6 c.ft. has now been supplanted by the 8, 9 and 10 c.ft. models, the changeover having been accelerated by the general introduction of across-the-top freezing units and fully automatic defrosting, far more than by style changes.

The volume of trade-ins of out-of-date models is now believed by the trade to have passed its peak. Some dealers predict early saturation of the market. Others feel that rural electrification, new house building and the advent of natural gas in Eastern Canada will keep business buoyant.

Gas-operated refrigerators are used principally in Alberta, where cheap natural gas has been available for over 50 years. The Trans-Canada Pipeline project will bring natural gas to Eastern Canada late in 1958, but it is unlikely that domestic gas appliances especially in refrigerators will be able to challenge the entrenched electricity interests seriously for several years. Opinion expressed in the Province of Quebec is that, until commercial users have been satisfied, no serious attempt will be made to exploit the domestic field.

The secondary demand for small refrigerators up to 6 c.ft., although mainly in the $1\frac{1}{2}$ and $2\frac{1}{2}$ c.ft. capacity, covers quite a wide field, but the total trade volume is relatively small.

Bachelor apartments use small refrigerators as space savers and business has been increased by a tendency to change over from centrally controlled to individually operated refrigerators in apartment blocks. Apparently the use of a central unit led to high servicing costs.

Owners of housekeeping cabins for transient motorists also favour the small refrigerator. It reduces the cost of equipping the cabin and, and, normally, is quite adequate for the overnight needs of a family.

The need to keep certain drugs under refrigeration has created a further outlet for small refrigerators for use in doctors' offices and drug stores.

On the other hand, there has been a falling off in the sale of small refrigerators for summer cottages, the tendency being to store larger stocks of perishable foodstuffs brought in from periodic excursions to city supermarkets. A growing use of the small unit, however, and one which seems capable of further exploitation, is as a second household refrigerator for the basement bar or recreation room.

New models of electric refrigerators appear in March or April. The peak selling season extends over the months of April, May and June. Sales slacken off during the summer months but usually rise slightly during the late autumn.

Design and Styling

There was a major design change in 1956 with the introduction of fresh streamlining. The new square or sheer look, as it is described in the trade, seems to have been suggested by the latest building and decoration trends and to have been introduced because near saturation of the market dictated a radical change in design to stimulate business.

Most manufacturers produce a standard and a de luxe version of each model in white, with colour and two-tone finishes offered at slightly extra cost for the de luxe models. Whilst these colour finishes have not proved popular, they are unlikely to be discontinued because of their value as an advertising and showroom attraction. In Toronto, coloured units are being put into many new luxury apartments.

As with all major appliances, the manufacturers seek to introduce new sales features each year, either by way of gadgets or improvements, The policy, highly successful in North America, is to induce trade-ins long before the serviceable life of the article is ended. In general, the following are now regarded as essential features and are to be found on all new models of 8 c.ft. and upwards :—

(*a*) Automatic defroster.
(*b*) Adjustable steel shelves, which roll out or revolve.
(*c*) Meat tray.
(*d*) Vegetable freshener.
(*e*) Temperature control.
(*f*) Automatic interior lights.
(*g*) Removable door shelves.
(*h*) Butter keeper.
(*i*) Ice trays.
(*j*) Egg storer.

Extra features for de luxe models are :—

(*a*) Large bottle storage trays inside the door. These increase the shelving storage space in the refrigerator itself.
(*b*) Ice ejectors.
(*c*) Separate door to freezer compartment.
(*d*) Right or Left-hinged or two-way doors.

The standard exterior finish is porcelain enamel and for the interior acid-resisting baked enamel. Capacity and dimensions may be summarized as follows :—

Total capacity : from 8.1 to 14.1 c.ft.
Food freezer capacity : from 1 to 4 c.ft.
Frozen food capacity : from 35 to 140 lb.
Total shelf area : from 13.6 to 25.0 sq. ft.
Overall height : from $57\frac{1}{2}$ to $69\frac{3}{4}$ in.
Overall width : from 24 to 32 in.
Overall depth : from $24\frac{1}{2}$ to 25 in.

British machines at present on sale include a small table model of 1.5 c.ft. capacity, a free standing one of 2.3 c.ft. and another of 4.2 c.ft. capacity ; shelf areas are 3.1 sq.ft. 5 sq. ft. and 8 sq. ft. respectively. None of these models has a food-freezing compartment.

How the Business is Done

Large manufacturers normally sell direct to appointed dealer outlets, usually department stores, furniture stores, electric appliances dealers and hardware stores. Some Canadian refrigerators and most models imported from overseas are, however, sold through distributors who are usually electrical wholesalers.

Due to the prohibitions on resale price maintenance, price cutting in all major electric appliances is common. There are discount houses and cut-price dealers in most large cities, and their activities have forced the department and mail order stores into special brand name production arrangements with United States manufacturers, as described in paragraph 4 (*d*) above. One Canadian manufacturer is supplying several firms, mainly in Quebec Province, on the same basis.

Promotional Activities

(*a*) *Advertising.*—Extensive advertising in daily newspapers and popular periodicals is carried on by most Canadian manufacturers, and departmental stores actively promote their " house brands " in the newspapers. Manufacturers also advertise in trade journals such as *Radio, T.V. and Appliance Trade Builder* published by Hugh C. MacLean Publications Ltd., and *Radio-Television and Appliance Sales* published by the Fullerton Publishing Company of Toronto. Radio and television advertising is common. In addition, most Canadian manufacturers benefit from the large-scale advertising carried on by their associate United States firms, much of which overflows to the Canadian public. United Kingdom manufacturers cannot hope to advertise on a similarly large scale, but fortunately the sale of small-size refrigerators is not so dependent on this factor. However limited publicity, stressing the special advantages of small refrigerators for certain purposes, should help to expand the demand.

(*b*) *Servicing Standards.*—It is normal for North American manufacturers to provide customers with warranties which

allow free repair facilities for one to two years on the whole machine, and for five years on the sealed unit.

In some cases faulty mechanisms, during this period, cannot be repaired by the dealer, but are shipped to the factory or regional repair depot for attention. All expenses are reimbursed to the dealer. Many dealers have their own repair facilities and carry out repairs on refrigerators not under guarantee, but repair facilities are also available for most makes from factory branches or appointed servicing centres.

United Kingdom manufacturers should ensure that similar facilities exist for servicing their products. Fortunately most large departmental stores and electrical wholesalers are equipped to provide servicing, if adequate spares are available.

Prices

The following suggested list prices are given as a general guide only. Owing to the prevalence of price-cutting, prices are liable to frequent change and a cash purchase will always secure a substantial discount which may be as high as 25 per cent. A limited number of manufacturers' pamphlets will be available for inspection at the office of the export services branch of the Board of Trade, London by interested firms in order of receipt of applications.

Price Comparison

				$
FRIGIDAIRE				
SA–81C–57	8.1 c.ft.			273.95
,,	with crisper			280.95
FS–101C–57	10.1 c.ft.	Automatic defrost		430.95
FD–102C–57	10.2 c.ft.	,,	,,	571.95
FD–120C–57	12.0 c.ft.	,,	,,	526.98
FI–121–57	12.1 c.ft.	,,	,,	711.95
CP–123C–57	12.3 c.ft.	,,	,,	690.95
CP–141–57	14.1 c.ft.	,,	,,	795.95
VIKING (T. Eaton Co.)				
957M	9 c.ft.			239.95
1057M	10.5 c.ft.			289.95
1257T	12 c.ft.	Automatic defrost		419.95
1257M	12.8 c.ft.			325.95
1357D	13 c.ft.	Automatic defrost		469.95
1457D	14.2 c.ft.	,,	,,	529.98
PHILCO				
974	8.6 c.ft.	Automatic defrost		369.95
973	9.5 c.ft.			319.95
1176	10.2 c.ft.	,,	,,	499.95
1276	12.3 c.ft.	,,	,,	599.95
1277	11.9 c.ft.	,,	,,	669.95
1278	11.9 c.ft.	,,	,,	689.95
1478	13.6 c.ft.	,,	,,	749.95
COLDSPOT (Simpson-Sears)				
8720	8.1 c.ft.			239.95
1710	10.7 c.ft.			264.95
1720	10.1 c.ft.	Automatic defrost		294.44
1730	10.1 c.ft.	,,	,,	344.45
7320		,,	,,	494.95
WESTINGHOUSE				
DK–80				299.95
SK–100				339.95
FK–100				359.95
FK–120				499.50
DBJ–114				519.95

The following are retail prices of United Kingdom makes on sale :—

		$
1.5 c.ft.	(table model)	129.95
2.5 c.ft.		159.95
4.2 c.ft.		159.95

New Developments at London Central Meat Company's Abattoir and Cold Store at Hardingstone

EXTENSIVE new developments have taken place recently at the Hardingstone Abattoir of The London Central Meat Co. Ltd. The abattoir, with its accompanying cold storage rooms, is one of the most modern in the Midlands and is located within a few miles of the company's central office in Northampton.

In addition to a new slaughter-hall, further refrigerated storage rooms have been completed in the last few months. These consist of an 8,650 c.ft. pre-cooling room and a 1,080 c.ft. offal chill room both of which are cooled by Frigidaire equipment and have been installed by Howards Refrigeration Ltd., Frigidaire distributors of Luton. The large pre-cooler chill room is cooled to a temperature of 50° to 55° F. with six forced air evaporators operated by two 5 h.p. water-cooled Frigidaire compressors, while the offal room is maintained at a temperature of 30° F. by one forced air evaporator in conjunction with a Frigidaire air-cooled compressor, Model AD4–150. " Frostmaster " automatic defrosting is fitted to both rooms.

The introduction of these new buildings and equipment—which also include an improved loading bay and ramp—have made it possible for the company to increase substantially their distribution of imported and home-killed meat to those of their branches that are situated within a radius of 70 miles of Northampton.

The abattoir was originally taken over by The London Central Meat Company shortly after the de-control of meat marketing in 1954. The following year, to assist and improve their distribution system, the company installed an 8,720 c.ft. freezer room for the storage of imported Canterbury Lamb and a 5,200 c.ft. pre-cooler chill room for the pre-cooling of home-killed produce. These rooms, also installed by Howards of Luton with Frigidaire equipment, were designed to operate at 16 to 20° F. and 50° to 55° F. respectively.

In the freezer room five Frigidaire ceiling-mounted forced air evaporators equipped with " Frostmaster " automatic defrosting are hooked up to two water-cooled condensing units, models WD6BS–500/M and WD6–300/M. For the pre-cooler chill room a 5 h.p. water-cooled Frigidaire compressor operates with four forced air evaporators with " Frostmaster " fitted.

With the installation of the two recently completed chill rooms, a total of 23,650 c.ft. of refrigerated storage is now available to contend with the expanding output from the two slaughter-halls. In the last few years this output has increased considerably and while it varies according to seasonal changes, the average weekly figures are at present up to 1,500 Canterbury lambs, 400 locally-fed lambs, 300 pigs and 175 head of cattle.

In addition to the abattoir at Hardingstone, The London Central Meat Co. Ltd., have two other slaughter-houses as well as three cold stores in other parts of the country. To ensure that the produce from these centres arrives in perfect condition fleets of insulated delivery lorries are used to carry the meat to nearly 400 branches spread throughout England and Wales.

Welding in the Construction of Refrigerating Units

By A. G. AREND

THE uses of welding in the construction of refrigerating unit designs are claimed to have developed production with greater dispatch than almost any other enterprise. Accordingly each item has been studied in detail in order that no hold-up will arise, while in many cases the tubing, tube-plates, and welding rods are more or less standardized. Permanent tightness of all joints is considered the most essential feature for uninterrupted operation of the unit. The efficiency of the unit can be quickly lowered by the smallest leak, and completely stop its action. Not only must welding be carried out with the greatest care, but following welding, testing for leaks must be fully checked. The system of testing requires to be such as to detect the most minute pin-hole, since the fluids and gases under pressure include hydrogen gas, ammonia, and water, etc. In one arrangement, the seamless tubing to be joined ranges from 12 to 17 gauge in wall thickness, and from $\frac{1}{4}$ to $4\frac{3}{4}$ in. diameter. The analysis is maintained at a maximum of 0.16 per cent. carbon, 0.2 per cent. silicon, 0.05 per cent. of both sulphur and phosphorus, and 0.15 per cent. copper, while manganese is allowed to range from 0.25 to 0.60 per cent. All of this tubing after being severely cold worked on tube reducers, is bright-annealed in a continuous electric furnace within a controlled atmosphere. The tubing then goes to a somewhat extensive programme of cutting, forming, bending, drilling and fabricating. After this, it has to be cleaned and sandblasted before passing to the welding shop. Not a few improved bending techniques have been introduced including rotary and circular, pushing, and special hairpin systems, and all of which are largely done without inside arbors being used. The bright-annealing eliminates scale formation, and accords a maximum tensile strength of 25 tons per sq. in., and a nominal hardness approximating to 50 Rockwell B. in general.

Non-Stop System of Production Adopted

Welding rods of two main sizes are used, namely, $\frac{1}{16}$ and $\frac{1}{8}$ in., but the analysis of these does not suffice to indicate their suitability, although this was accepted in earlier years. A vital point in ensuring that all welds are leak-proof is that freedom from all inclusions, gas bubbles, and scale, be considered more important than actual analysis. It was found that when a shipment of inferior welding rod was used, the percentage of leaks increased materially, which resulted in all consignments being fully tested before application. While gas welding is largely used, with hydraulic welding seals, which each serve two torches, submerged arc welding is engaged to join the halves of the shell of the absorber. In order to locate and clamp the two mating parts, a special fixture is constructed, and the work is then revolved to meet the welding arc, while a spout feeds through the necessary granular flux. In this way, the weld is thus submerged in an atmosphere which excludes oxygen, and the rate of cooling is slowed down. For the welding of the pressure assembly, the same procedure has been tried out experimentally, although it is not known if it has yet gone into production. As distinct from earlier practice, oxygen is supplied by special trucks in the liquid condition, transferred to a receiving tank, and then in auxiliary tanks evaporated from liquid to gas. This is piped to the welding stations at 28 lb. per sq. in. compared with a line pressure for acetylene of 12 lb. per sq. in. A total of 21 pieces, 28 finished welds, and 2 tack welds are necessary for the evaporator and gas heat exchanger assembly. For the generator assembly, 17 parts, 30 finished welds, and 12 tack welds are required.

Parts such as fins, discs, cups and plates, are not included in the foregoing numbers. Conveyorized assembly lines permit welders to keep

pace with the moving work, and entirely eliminate lost motions in stacking and handling sub-assemblies. For the condenser weld, this involves 25 parts in its tube and fin assembly, 22 finished welds, and 22 tack welds, and for which latter purpose, tacking tables are located along the conveyor line. There are thus three sub-assembly lines, namely, for the evaporator and gas heat exchanger, the generator, and the condenser and absorber, and all of which meet in proper alignment for the final assembly. The regular and smooth operation of the conveyor system contributes to the decline in the percentage of leaks.

The Finished Unit

The finished unit, after a cooling shower, is placed in a sealed and strengthened booth, and subjected to a rupture test at 1,000 lb. per sq. in. After applying a soap solution to all joints, each unit is then tested under a pressure of 800 lb. per sq. in., and bubbles form at the point of the leak if a weld is defective. Any leaks are then repaired, re-testing done, and to rectify any warpage which might be caused by welding, the complete unit is put through a straightening fixture. After painting, testing is again done, followed by charging with ammonia, water, and hydrogen gas, when the accuracy of refrigerating capacity is checked on a test rack where it is given a calorimetric run-in test. What is considered a masterpiece of welding is represented by the completely gas-tight joining of the tubes to the tube-plates, the difficulty of which resides in the close proximity of the welded joints. The tube-plates heat up considerably in welding, and are therefore liable to warp, a tendency which is further favoured by the large number of holes in them. It is absolutely necessary however, to prevent any such deformation, because it would endanger the tightness of the welded seams already made. If any deformation has taken place, it can either not be eliminated at all, or if eliminated will tend to leave dangerous initial stresses in the material. As can be understood, this requires all the more attention on the conveyorized system, and accounts for the care devoted to each section of the work. It is claimed that refrigerating equipment could never have been brought to its present state of perfection without the aid of welding, particularly in the field of absorption machines.

Modern Refrigeration is obtainable from the manager, Maclaren House, 131, Great Suffolk Street, London, S.E.1, at thirty-five shillings per annum, post free to any part of the world.

New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

Richard Craven & Co. Ltd., 17, Princes Street, Harrogate. To carry on business of refrigeration, air-conditioning and general engineers, etc. Nominal Capital : £1,000. Permanent Directors : R. D. Craven and Mrs. M. L. Craven, Easthorpe, Crag Lane, Knaresborough.

J. Bennett Junr. (London) Ltd., 24, Monument Street, E.C.3. To take over business of wholesale fish merchants carried on by J. Bennett Junr. Ltd. and to carry on business of poulterers and cold storage proprietors, etc. Nominal Capital : £1,000. Directors : Silvester W. Smith, 10, Harewood Avenue, Bromley, Kent. Solicitors : Walter L. Tyler, 71, Clock House Road, Beckenham. Regd. by Solicitors ; Solicitors : C. Vince, Beckenham. Secretary : Percy E. Moore.

Wardar's (Import & Export) Co. Ltd. To carry on business of meat salesmen, brokers and merchants, butchers, etc. Nominal Capital : £10,000. Directors : John E. Menear and Harold A. Tayler, addresses not stated. Subscribers : Alan D. Johnson, 104, South Lodge Drive, Southgate, N.14 (acct.) ; Joan M. Darrington, Thatched House, Broom Close, Esher, Surrey. Regd by Solicitors : Thos. Wm. Hall & Sons, 61, West Smithfield, E.C.1. (co. director).

Deep Freeze (Luton) Ltd., Charles Street, Luton. Secretary : E. J. Cornthwaite. To carry on business of poultry processing and public cold storage contractors, contractors: for quick freezing, deep freezing, etc. Nominal Capital £3,000. Directors : Ernest J. Cornthwaite and Ella I, Cornthwaite, 106, Old Bedford Road, Luton. Regd. by Solicitors : Machine & Co., Luton.

Dust Suppression Ltd. To carry on business of buyers and sellers of plant and machinery for the suppression of dust and air conditioning, etc. Nominal Capital : £1,000. Directors to be appointed by subscribers. Subscribers : Hazel K. Hebben and Marian Beadle, 59–67 Gresham Street, E.C.2. Regd by Solicitors : Linklaters & Paines, E.C.2. (clks).

Grimsby Rentals Ltd. To carry on business of electrical radio, television, refrigeration, nucleonic and mechanical engineers, etc. Capital : £100. (Secretary : H. Huxford). Directors : Harold Huxford, 142, Farebrother Street, Grimsby, Edward J. Huxford, 15, Hainton Avenue, Grimsby (both permanent). Registered by Parker and Glentworth, 17, Hainton Avenue, Grimsby.

Harold Husford Ltd. To carry on business of electrical, radio, television, refrigeration, nucleonic and mechanical engineers, etc. Capital £100. (Secretary : H. Huxford). Directors : Harold Huxford, 142, Farebrother Street, Grimsby, Edward J. Huxford, 15, Hainton Avenue, Grimsby (both permanent). Registered by Parker and Glentworth, 17, Hainton Avenue, Grimsby.

M. M. (Import, Export) Ltd., 36, Southampton Street, W.C.2. Secretary : Lawson (London) Ltd. To carry on business of manufacturers of and dealers in refrigerators and cold storage machinery and plant, etc. Capital : £100. Director : Maurice Mitzman. Subscribers : M. Josephs, 36, Southampton Street, W.C.2. (accountant) ; Leo Singer, 68, Chaffers Mead, Ashtead, Surrey (accountant). Registered by Lawson (London) Ltd., W.C.2.

Mechanical Kold Ltd., 411 West Green Road, N.15. Secretary : Elsie Clements. To carry on business of manufacturers of and dealers in refrigeration, air-conditioning and water cooling equipment, etc. Capital : £500. Directors : Ernest J. K. Clements and Elsie Clements, 51, Edenbridge Road, Bush Hill Park, Enfield, Middlesex. Registered by Business Economy Products, Ltd.

SHOP REFRIGERATION NEWS

THE BUTCHER'S SHOP

Refrigerated Display for the Retail Purveyor

By our Special Retail Correspondent

THE legend "Families waited upon daily" is still to be seen on the sides of the delivery vehicles of butchers with individually owned and operated shops. But those vehicles, as well as the families who expect to be waited upon daily at the tradesmen's entrance, diminish in number every year. The family's meat to-day is acquired on a principle of cash-and-carry. That statement is a generality to which exceptions are becoming steadily more rare. It may also be said to form the basic theme of this article, because it makes more evident than ever before the imperative need for refrigerated display in the butcher's shop.

It does not make much difference which way you interpret the term "family butcher"—as an old-established butchery business run by a family for three or more generations, or as a business with a delivery-round to households of successive generations in one family. The butcher's shop run by the grandson of its original owner or which serves the married granddaughters of some of its early customers is now sufficiently unusual to be pointed out as unique in its locality. It will almost invariably belie its longevity by its up-to-date appearance. It may conceivably provide the best example in the district of the effective use of refrigeration as an aid to showmanship.

Emphatically, it is not lack of enterprise or of skilled craftsmanship that has brought about the large diminution in the numbers of family butchers. The decline started with the growth of the multiple-shop companies: the absorption of the small shop by big business.

I think it will be true to say that, for the last 25 years, the typical butcher's shop has either carried the name of one or another of the large multiple companies on its fascia, or else, though still bearing its former name, has been known, as an open secret, to be under the control of one or another of those organizations.

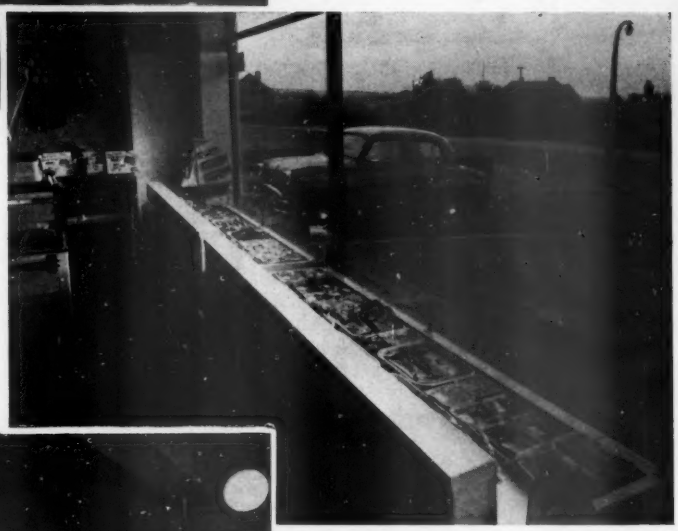
Fig. 1.—Shopfront and refrigerated window of Mr. A. J. Beard's shop at Wellington, Salop.

The strange part of it is that these centrally controlled shops vary as much in their standards as the owner/server shops. There still are hundreds of multiple butchers' shops without any visible sign of refrigeration. Multiple, that is to say remotely controlled, operation is by no means a *sine qua non* of efficiency and progress. For every superbly equipped multiple butcher's shop with temperature-controlled, adequately protected display (and there are many of them) there is to be found a counterpart that looks and probably is, a survival of the early 1920s.

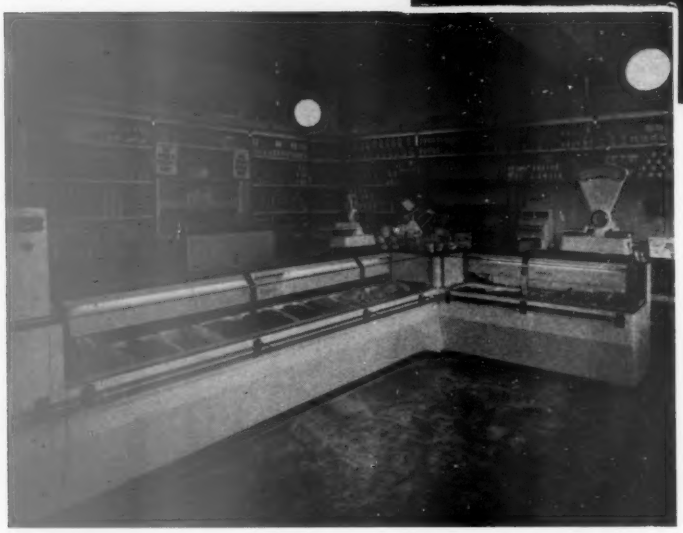
Now, the third phase of the modern history of meat merchandising is beginning to take shape : the selling of meat in ready-cut, ready-wrapped form. My approach to this new phase is dispassionate : influenced by neither propaganda nor prejudice. But here there is no hint of scepticism ; for here there seem to be no signs of a pressure group at work. Unlike the fresh fruit and

Fig. 2.—Close-up view of back of window. Installation by J. & E. Hall, Ltd.

Shopfront and refrigerated window slabs of Upton's, Rugeley, Staffordshire.



Sideview of open-topped, open-backed refrigerated window display at same shop.



Refrigerated L-shaped counter inside Upton's shop. Installation by J. & E. Hall, Ltd.

vegetable industry, in which the advantages of pre-packaging are still very much open to debate, if not indeed to serious doubt, the fresh meat trade has not, in this respect, become subjected to heavy broadsides of propaganda. The sale of meat in ready-wrapped form is a logical and almost inevitable result of certain social, economic, and technical developments and changes, which can be broadly summarized, though not adequately explained, by the description *cash and carry*.

The influencing factors are (1) a vast increase in the number of working housewives, with limited time for shopping, (2) their frequent lack of knowledge of meat and what to ask for, which makes it necessary for the retailer to do their thinking for them, *i.e.*, to have the meat ready-cut, and labelled with description and price, (3) the discontinuance of delivery service, which makes it necessary for the housewife to buy meat in smaller quantities which she can conveniently carry home with other commodities, (4) Sunday motor jaunts with meals out, which obviate the ritual of the Sunday joint,* (5) the steady advance of self-service, which has taken meat in its stride.

Cash and carry, which means the eradication of credit accounts and household deliveries, does not necessarily imply self-service. But self-service *does* pre-suppose the arrangement of facilities for the pre-packaging of the meat on or off the premises. It is relevant to quote here from an article

Mr. Stanley J. Stevens behind the new 8 ft. Prestcold display cabinet, fitted with hot gas defrosting, which is a feature of his smart progressive butchery shop at 67, Pyle Street, Newport, I.O.W.

" Refrigeration for Self-Service " in the October number of MODERN REFRIGERATION (pages 394–397) :

> " Look in any supermarket for fresh meat and it will be found ready-wrapped in a refrigerated cabinet . . . . Almost invariably there is a run of three, four, or more refrigerated display cabinets in one long line at the back of the store, with immediate access to the cutting-up and wrapping section. In some instances this preparation work is carried on within view of customers and behind the cabinets from which it is separated by a screen of clear plate-glass . . . pre-packaged meat is one of the outstanding successes of self-service. Several of the earlier stores operating on this principle were making indifferent progress ; but they took on a new lease of life when, on the abolition of meat rationing, they were able to introduce a butchery section from which all meat could be obtained in ready-wrapped form; . . . from now on, no supermarket or large self-service store will open without a meat department and *no such department can be run successfully without refrigeration.*"

I see no reason to qualify that statement. Indeed, subsequent supermarket developments—they have been opening at a rate of about one a week ever since that article was written—confirm the views then expressed. But I am not convinced that the sale of ready-wrapped meat by self-service is the right method of selling for the butcher's shop, either multiple or individual. In my opinion the butcher can compete far more effectively with the giants of self-service by offering

* For which, I understand, from first-hand information, and not necessarily for publication, the editor and his family provide a precedent.

housewives a complete contrast : by combining the refrigerated display of very representative cuts of meat and the immediately accessible bulk storage of carcases in a cold-room with a personal attention that makes it evident that whatever a customer wants she can have. And I say this with full knowledge of the fact that a number of butchers have successfully converted to self-service.

There will always be people who prefer this way of buying meat. They will tend to be in the minority ; but *an important minority*. It follows from this statement that the refrigeration salesman who plugs self-service to the butcher may be on a wrong tack. Large-scale self-service, with its inevitable accompaniment pre-packaged fresh meat, has now become an accepted method of food merchandising, and these outlets for the sale of meat will continue to grow. It is only too apparent that this will tend to reduce the number of butcher's shops ; but that is quite a different thing from saying that the butcher's shop will eventually disappear.

Without implying any criticism of or challenge to the butchers now operating on self-service—their success justifies their decision to convert, and probably there will be many more who will follow their example—I do consider it extremely important for butchers to realize, first, that their shops have something the self-service stores lack : the friendly contact, the individual attention, the unrestricted choice, the satisfaction the customer has of feeling that she is a privileged patron and not just one of a line of people taking what is laid out for them, and, secondly, that it is not necessary to go over to self-service in order to demonstrate that one is up to date, enterprising, moving with the times.

The shops illustrated in this article provide evidence substantiating the last point, and they all demonstrate the effective use of the refrigerated window display. In Mr. A. J. Beard's shop at Wellington, Shropshire, there are three levels of window display under refrigerated conditions, and access to the contents is provided by hinged doors. The 40 to 45° F. temperature-controlled area, 8 ft. wide by 2 ft. 4 in. deep, occupies the whole of the window. Another Shropshire butcher, Shutts (proprietor, Mr. A. D. Mitchell) of Newport, has a totally enclosed refrigerated window, and a sub-fascia fixed above the transome carries the words " Refrigerated Display " in stencilled letters illuminated by the window lights, and also serves to conceal a display of incidental items on top of the window case, intended to attract the attention of customers inside the shop.

It is about 2½ years since Uptons of Rugeley, Staffordshire, had the remarkably wholehearted change-over to refrigerated display carried out. If there is a more effective challenge to self-service, I have yet to find it. This shop contains 37 linear feet of refrigerated display : two 7-ft. slabs in the window, each held at 43° to 47° F. by a ½-h.p. machine unit, and an L-shaped display counter, 15 ft. 5 in. in the long section and 7 ft. 5 in. in the short section. In addition, there is a quick-frozen food cabinet embodied in the unit system of wall shelving. Behind the shop is a 340 c.ft. cold-room, held at 28° to 40° F.

All three of these installations were carried out by J. & E. Hall, Ltd. The refrigerated slabs in Upton's window are " Cooltops."

Singularly appropriate for mention in this article, in view of my reference to the rarity of family butchers, is the new shop-front of J. Williamson & Son at Cults, Aberdeenshire, who claim to be the oldest family butchers in the north of Scotland, and the first in north-east Scotland to install a refrigerated window.

A final example of butcher's refrigerated display comes from the extreme south—another Newport, incidentally—in the Isle of Wight. This shop in 67, Pyle Street belongs to Mr. Stanley J. Stevens, a member of a family well known in the butchery business in various parts of England, and a past-president and present treasurer of the I. of W. Meat Traders' Association. He is here seen behind his 8-ft. long refrigerated display counter.

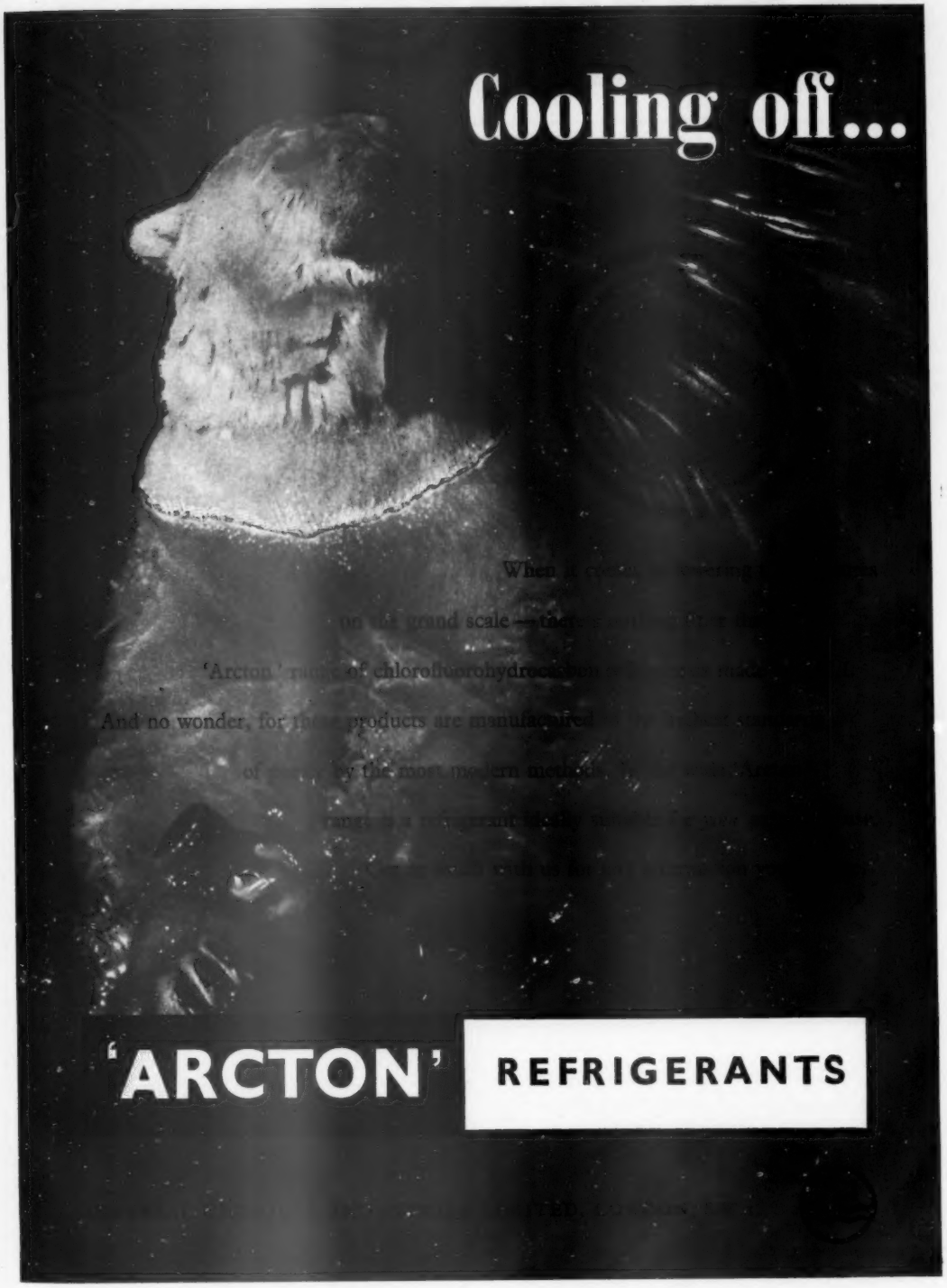
The two last-mentioned examples of refrigerated display for butchers are Prestcold installations.

NEW REFRIGERATED VESSELS

A new addition to world shipping is the refrigerated vessel *Carrillo* recently delivered by Cammell Laird & Company to the Caraibische Scheepvaart Maatschappij, N.V. and subsequently time-chartered to United Fruit Company for western hemisphere trading.

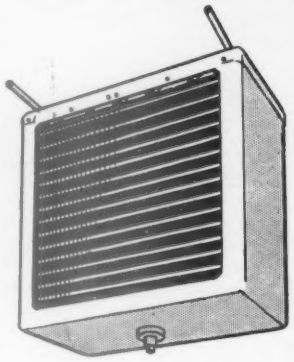
This ship, together with the two sister vessels, *Calamares* and *Cartago*, contains 255,000 c.ft. of refrigerated cargo space, is fitted with glass fibre insulation and uses " Freon " and brine for refrigeration. The main cargo system consists of three 16-cylinder machines driven by 100 h.p. electric motors.

G. J. Paddy & Sons Limited, insulation specialists of Bromley, Kent, announce that they have secured a contract for the insulation of two 2,000 ton −20° F. low temperature chambers at present under construction at Grimsby. The consultants for the main structure, now in course of erection, are Jenkins & Potter, 66, Victoria Street, S.W.1.

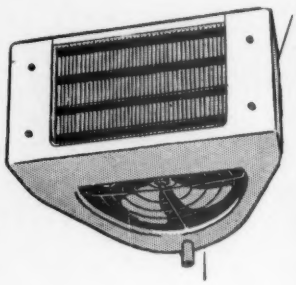

Cooling off...
'ARCTON'
REFRIGERANTS

Kelvinator

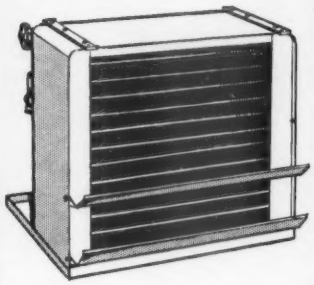
have all the answers



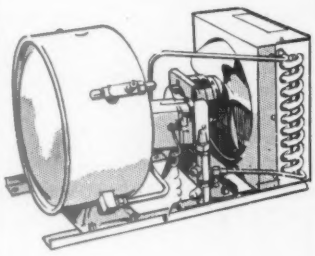
LTE COOLERS



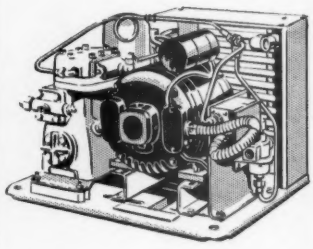
CFC COOLERS



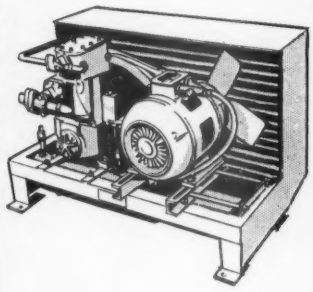
PACEMAKER COOLER



SEALED CONDENSING UNITS



WATER COOLED CONDENSING UNITS



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Refrigeration Controls—4

PRESSURE-OPERATED TYPES

By H. H. EGGINTON

(*Continued from March issue*)

Bleed Constant Pressure Valves

THE development of the hermetic type compression machine with split phase or low starting torque type motors, makes it necessary to balance the pressure across the piston under starting conditions, such that there is virtually no load for the electric motor at the beginning of a cycle. This starting condition is achieved normally by the capillary tube type of restricting orifice which allows the high- and low-side pressures to equalise during the " off " cycle. Normal forms of constant pressure expansion valves are therefore not suitable for this application, because they are designed specifically to close on the " off " cycle, *i.e.* when the evaporator pressure begins to rise. In application of the hermetic type of unit the question of getting liquid into the evaporator and compressor is controlled by the amount of liquid charged into the machine and the use of liquid reservoirs called headers. The bleed constant pressure valve is purely a constant pressure expansion valve with an orifice built into the needle and seat arrangement, either by notching the seat or by producing a flat on the needle, such that when the valve closes down there is still a small orifice available for the balancing of the pressures between the low and the high side of the unit (*see* figure 6).

Principal Requirements

These are identical with the requirements of normal constant pressure valves, except that the bleed requirement is built in and a number of different sizes are usually made available by the manufacturers of this sort of equipment to meet the various duties; in all other respects, material, construction, etc., these valves are usually identical with the normal constant pressure valves.

Operating Characteristics and Performance

The only differences which a bleed type valve produces in the working of a unit are to be seen at the beginning and end of the thermostat cycle. The small bleed orifice produces the state of affairs where the evaporator and condenser conditions tend to stabilise earlier than with a normal constant pressure valve, although this effect is extremely small. At the end of the cycle, however, the balancing-out effect of a bleed valve compared with a non-bleed version is most marked and it is quite characteristic to find that after five minutes with a bleed valve of suitable size, the high-and low-side pressures are within a pound or so of

By courtesy of A-P Controls Corpn., U.S.A.

Fig. 6.—Bleed orifice of constant pressure valve.

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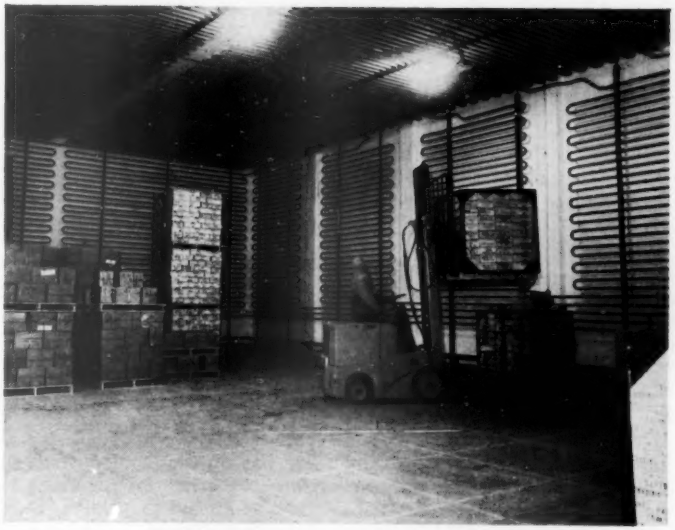
Rapid Progress of Large-Scale Projects

Enormous developments in cold storage are now taking place. Smiths Insulations Ltd. are using new techniques to build some of the largest and most efficient cold stores in the world, much more quickly than was hitherto possible. Photographs on left show progress on (1) a sub-zero store of one million c. ft. capacity ; (2) a simultaneous contract for a 600,000 c. ft. low temperature store.

Other contracts proceed at the same time for large fish, food, ice cream and beer stores. Our 84 years' experience and resources enable us to offer a complete service in the design and construction of cold stores of any size. By our methods of prefabrication, building time and costs are greatly reduced, and completion speeded up.

WATCH FOR FURTHER ANNOUNCEMENTS OF THESE VAST DEVELOPMENTS AND FOR WHOM THEY ARE BEING UNDERTAKEN.



This photograph shows a section of a new fish store recently completed in Hull. It has a capacity of 200,000 *cubic feet, with labour-saving palletization, giving low running costs.*

each other, whereas, under similar operating conditions a difference of some 60 lb. per sq. in. on dichlorodifluoromethane would be apparent with a constant pressure valve exhibiting reasonably good shut-off characteristics. Hence, with the latter there would be a heavy starting load on a hermetic or low torque type unit (*see* figures 7 and 8). The range adjustment and other features are identical with that of the normal type constant pressure valve and field adjustment, replacement, etc., are just as easy. It can be said, generally, that as effectively, give motor overload protection and maximum machine capacity under varying and extreme ambient temperature as the constant pressure valve, and hence with the latter motor loading may be reduced.

This type of valve normally is much less susceptible to dirt and moisture blocking compared with the average restrictor tube.

Application

The type of plant on which the bleed-type

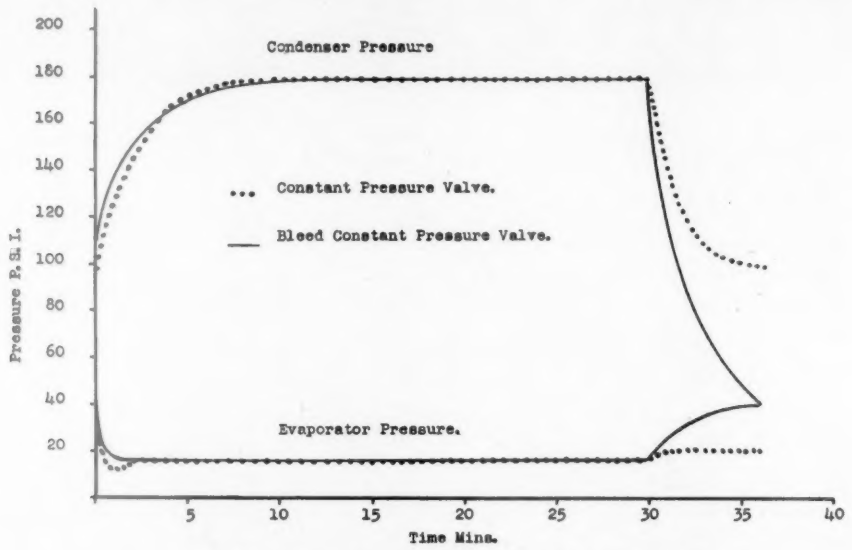


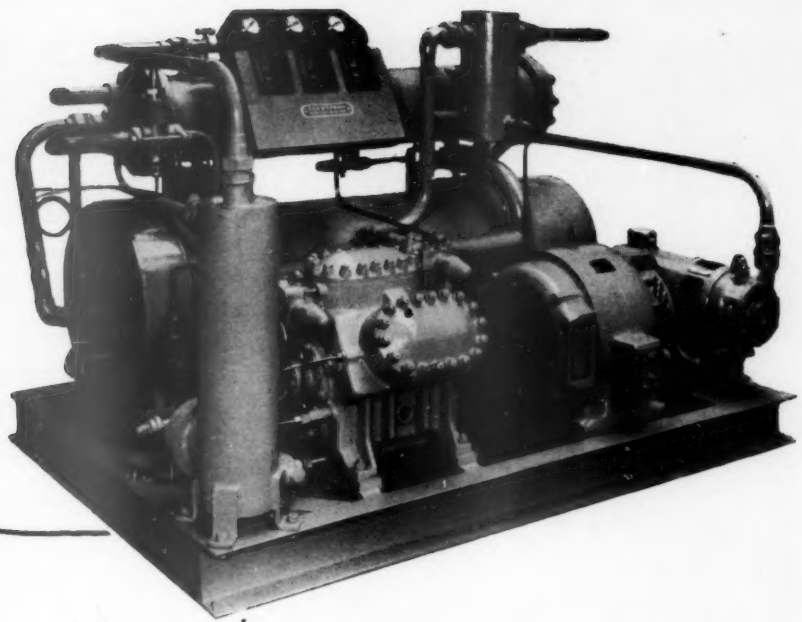
Fig. 7.

Control cycles on dichlorodifluoromethane hermetic unit
Comparing Constant Pressure and Bleed Constant Pressure Valves

the bleed type constant pressure valve has all the advantages and disadvantages associated with the normal sort of valve, plus the ease of application to the hermetic low-starting torque motor. The problems of application and all the advantages to be gained by utilising the constant pressure type of valve are common, whether bleed or not. It has been found in certain circumstances that the bleed constant pressure valve can show very definite advantages over the capillary tube; particularly is this true where a small number of special hermetic type plants have to be built and ascertaining the ideal capillary can be lengthy and costly, a feature completely eliminated by using a bleed-type constant-pressure valve. In addition, there is also some evidence that under certain conditions, a bleed constant pressure valve may demand even a lower horse-power motor than a capillary-type unit. Capillary restrictors cannot, constant pressure valve is applied is usually the same as that described for the constant-pressure valve, bearing in mind the primary requirement of the hermetic type of unit. It is true, however, that systems which quite often need rapid service, such as ice cream cabinets and air-conditioning equipment, may be put back into operation more rapidly under defective conditions when the constant-pressure valve can be re-adjusted or easily replaced, compared with the state of affairs of a capillary tube. On the other hand, it is certainly true that the economics of the bleed-type constant-pressure valve, apart from these field advantages, can never, on prime costs, compare.

Checking the Size of the Bleed

Most manufacturers only offer three or four bleed rates and generally speaking there is little problem in selecting an appropriate size of bleed



NEW PACKAGED WATER CHILLER

We illustrate our 10 horse power packaged water chiller which is being exhibited at the Brussels World Exhibition 1958.

This unit is the smallest of an entirely new range of packaged water chillers which are available in graduated capacities up to 100 horsepower.

Complete and ready for connecting to water and electrical supplies, why not save time, money and above all space by specifying Lightfoot Packaged Water Chillers ?

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BRITISH INDUSTRIES PAVILION

by **LIGHTFOOT REFRIGERATION**

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THE LIGHTFOOT REFRIGERATION CO. LTD., ABBEYDALE ROAD, WEMBLEY, MIDDLESEX

for a given application. There is little danger in choosing a bleed slightly small as far as performance of the plant is concerned and as long as the "off" cycle is sufficiently long to let this bleed balance the unit. There is, however, the complication to be avoided of having a bleed too large. To check that this is not so the valve should be set much lower than the level at which it is normally intended to be operating. The plant should be set running and the suction pressure measured by a gauge in the suction line. If the pressure falls below that at which the evaporator will normally be controlled by the valve, then the bleed is not excessive and satisfactory performance should be obtained by setting the valve at all pressures higher than that achieved with the valve in the closed condition where the bleed is alone feeding the evaporator.

Chart by courtesy of Teddington Refrigeration Controls Ltd.

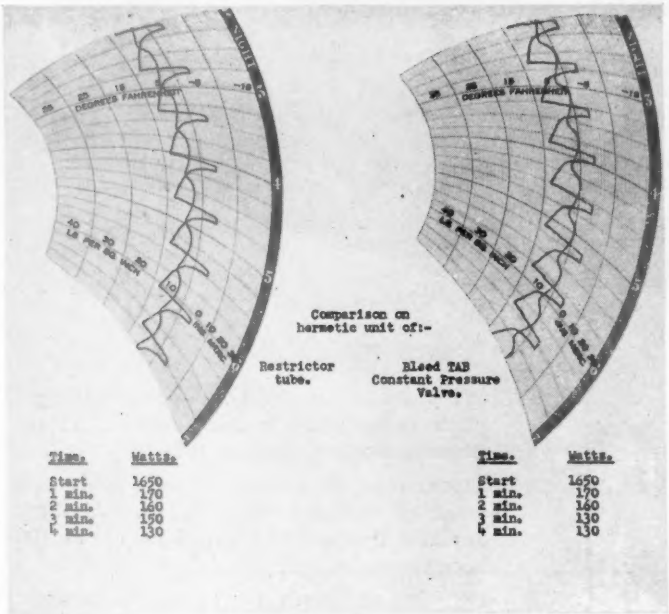

Fig. 8.—Capillary restrictor and bleed constant pressure valve — comparison of control and motor loading.

Trouble Shooting

The chart prepared for normal constant-pressure valves can be applied to bleed-type constant-pressure valves, bearing in mind that the valve is specifically designed not to shut off. This type of valve should only be used on compression refrigerating machines designed, and refrigerant charged, to balance high-and low-side pressures on the off cycle. On no account should they be used as replacement for normal constant pressure expansion valves.

United Kingdom manufacturers with representatives in Italy may be interested to know that the organizers of the 13th Mediterranean Fair (May 24 to June 10) are encouraging British participation by offering exhibition space, the setting-up of displays, cleaning and electric current, all free of charge. Those firms not already represented in Italy and who think they have a possible outlet for their goods in Sicily and Southern Italy may also be interested in taking part. They may be able to obtain suitable local representation as a result of their display and possibly to sell their exhibits on the spot. Last year the Palermo Fair provided 70,000 sq. metres of cover space out of a total fair average of 125,000 sq. metres. The attendance was about 600,000. Of about 2,000 exhibitors 1,500 were Italian and 450 foreign. Twenty-one foreign countries were represented at the Fair.

* * *

The Board of Trade has been informed by the British Embassy, Lisbon, of a publication in the Portuguese Diario do Governo, series I, no. 262 of decree law no. 41375. This decree sets out the procedure to be adopted by the Portuguese Government and the autonomous services of the State in signing contracts for the supply of material, the carrying out of works or the renting of buildings. A translated copy of the decree law is available on loan to United Kingdom firms in order of receipt of applications.

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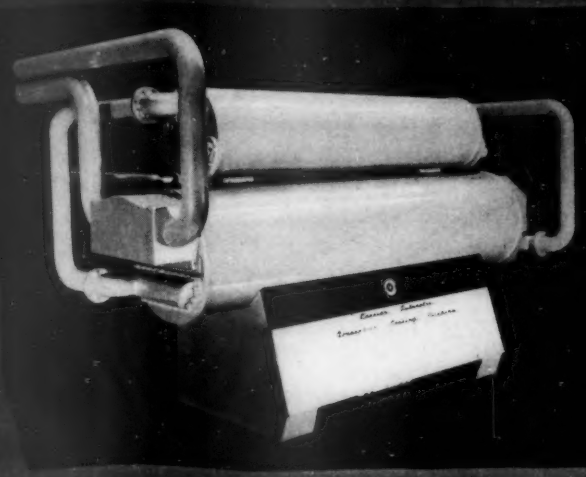

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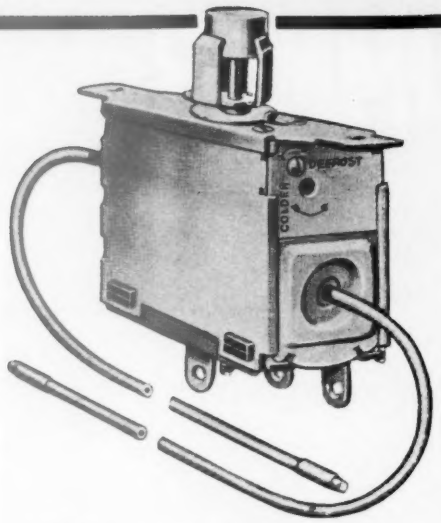
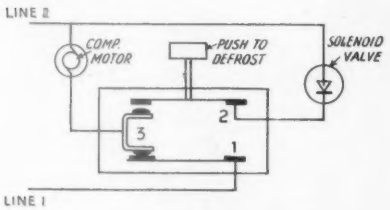
"Ranco Ltd." offer their congratulations to "Modern Refrigeration" on their Diamond Jubilee Year and on its reports of the research and development in Refrigeration from the first ice-box to the present day "automation".

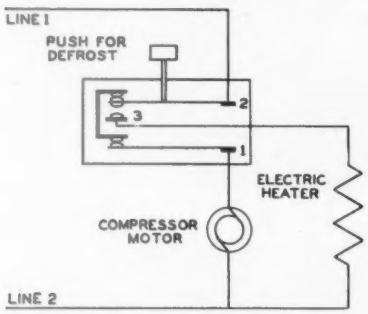
"Here are a few of RANCO AUTOMATIC Defrost Controls acknowledged for progressive design, high quality and lasting reliability and widely used throughout the Industry."



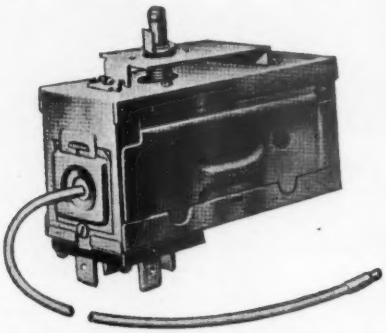
"The Ranco type 'F' controls have been developed especially for the Household



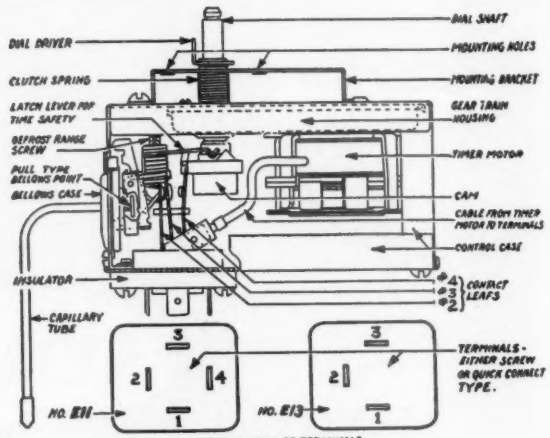
Refrigerator with Push-button defrosting. These controls combine both operations



of DEFROSTING and TEMPERATURE CONTROL. The Type F14 works in conjunction with Ranco 'V' Series Hot Gas Magnetic Valve."



"The Ranco 'E' Series control automatically starts the defrost cycle at a fixed time each day, and stops the defrost cycle at a fixed temperature. This control is in addition to the normal thermostat.



Sectional view of E11 & E13

"The Ranco 'E 11' Control with manufactured synchronous timer motor is designed for Electric Heater Defrost systems and the Ranco 'E 13' control is designed for Hot Gas Defrost systems."

OPERATION

"The Ranco 'E 11' is a single pole *double* throw switch. The 'E 13' Control is a single pole *single* throw switch."

"When the predetermined time for starting the defrost cycle is reached, the defrost circuit closes, operating the defrost device, an Electric Heater or Solenoid for Hot Gas type. The power element, which is only responsive to the evaporator temperature, opens the circuit when the predetermined defrost temperature is reached."

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The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENtral 4694)

MAY MEETING

At a meeting of the Institute to be held at 5.30 p.m. on Thursday, May 1, 1958, at the Junior Institution of Engineers, Pepys House, 14, Rochester Row, Westminster, London, S.W.1, Mr. G. Laing, associate member, will present a paper entitled " Current practice in marine insulation."

The following is a synopsis of Mr. Laing's paper :—

Survey of the present methods in insulating a refrigerated cargo ship, with the associated problems of condensation, air leakage and the effects of cargo damage.

Discussion on methods of testing, calculation of transmission coefficients and the question of guaranteeing insulation efficiency with summary of probable future developments to improve present standards.

Review of other marine insulation problems on domestic cold chambers, accommodation and ancillary services with details of methods of complying with fireproof division regulations.

EXECUTIVE COUNCIL ELECTIONS

Mr. J. A. Brewster, Dr. J. C. Fidler and Mr. G. Yate Pitts, corporate members, and Mr. R. H. R. Lloyd, companion, have been elected to fill the vacancies on the executive council caused by the retirement, under by-law 10, of Mr. G. L. H. Bird, Mr. J. H. Brier and Mr. J. A. Stonebanks, corporate members, and Mr. W. A. King, companion.

Mr. H. R. Howells has been elected to fill the vacancy on the council for a corporate member to complete the unexpired portion of the late Mr. A. O'B. Brandon's term of office, *i.e.* to March 25, 1960.

HONORARY TREASURER

At a recent meeting of the executive council, Mr. T. A. Raymond was re-elected honorary treasurer of the Institute for the year March 26, 1958, to March 25, 1959.

MEMBERSHIP

At the meeting of members held on March 6, 1958, the following were elected to membership of the Institute :—

Associate Members

*Cowley, Leslie, 81, Nursery Road, High Brooms, Tunbridge Wells.

Etherington, John Frederick, " Elsworth," Princess Close, Wistaston, Crewe, Cheshire.

Laing, George, 1,310, Paisley Road West, Glasgow, S.W.2.

* Transfer from Associate.

Associates

Hobbs, Kenneth George William, 79, Garvan Road, London, W.6.

Lebentz, Charles, 133, Old London Road, Hastings, Sussex.

Owen, Andrew Glyn, 11a, Hartington Road, London, W.4.

Scutt, Robert Clifford, 52, Hadley Way, Winchmore Hill, London, N.21.

Graduates

Davis, James Frederick, 131, Castlewood Drive, Eltham, London, S.E.9.

Foley, Leslie Hillman, 17, West View Road, Dartford, Kent.

Miwafi, Mohamed Mahmoud, 75, Edge Lane, Stretford, Manchester.

Oliver, Brian Cecil, 13, Manse Way, Swanley, Kent.

Porter, Thomas, 8, Penlan Crescent, Glanmor, Swansea.

THE HEATING AND VENTILATING RESEARCH COUNCIL

IN their recently published second annual report and statement of accounts, the Heating and Ventilating Research Council refer to 1957 as a period of building up from the small beginnings of 1956 when, through difficulties in obtaining staff, it was not possible to make any great progress until the latter half of that year. Despite similar problems in the second year of operation, the council report that the research work has been established on a firm basis, and that it has been possible to consider further extension of the number of projects in hand.

The highest priority has been, and is being, given to intermittent heating—a subject embracing both heating and ventilation practice—and a confidential report on the researches so far carried out has been circulated to members. Other projects initiated during 1957 included two further priorities—the design and performance of high velocity ventilation systems and the study of the application of automatic controls to heating and air-conditioning plants, the latter having developed logically from the intermittent heating investigation. Of the original four researches designated as priorities, only one remains to be started, *i.e.* design procedures on high-temperature radiant-heating systems.

The financial position of the council continued to strengthen during 1957. A favourable indication for the future was the increase of 50 per cent. in subscription from January, 1958, promised by the contractors ; the new rates of subscription together with grant aid from D.S.I.R. made it possible to anticipate an income of more than £17,000 for 1958. At December 31st, 1957, the membership of the council stood at 220 comprising 163 subscribing contractors, 29 consulting engineers, 9 automatic control manufacturers, and 19 other subscribers. During 1957 a membership drive by the vice-chairman had been in progress, and this had shown gratifying results which would become apparent in 1958.

Continued attention had been given to the provision of information services for both members and staff of the council, while liaison with various other bodies working in similar fields had been extended. Liaison visits had been made by the staff to both member and non-member firms, mainly in connexion with the research activities ; in the coming year every opportunity would be taken to increase this activity.

Applications for copies of the report should be made to the Secretary, The Heating and Ventilating Research Council, B.C.U.R.A. Laboratories, Randalls Road, Leatherhead, Surrey.

Cold Store Design in France

IN an interesting paper, " Modern trends in cold storage design and operation in France," which he presented before the March sessional meeting of The Institute of Refrigeration, Monsieur Pierre Vidal, general manager, Entrepots Frigorifiques Lyonnais, Lyons, said that in 1949, the gross capacity of public or semi-public cold stores reached 565,000 m³, corresponding to a useful capacity of 425,000 m³ divided between about 100 establishments. Since that time, the capacity had increased by about 100,000 m³ from new building, enlargement and modernization.

The present figure of 500,000 m³ utilized applied to 136 cold stores, each being larger than 250 m³. Storage at a temperature of 0° (or near) was possible in 42 per cent. of the space, while 58 per cent. could be used for the preservation of frozen products.

" The predominance of low temperatures increases every year," declared Monsieur Vidal. " In spite of difficulties in deciding the precise meaning of the cold storage utilization coefficient, it is to be noted that this coefficient increases, regularly. From 33 per cent. in 1951, it now exceeds 47 per cent. For all cold stores, the highest level of utilization takes place during the summer quarter, and the lowest between February and April.

" The Paris area enjoys a privileged situation ; not only because the population is very high, but also owing to a highly centralized administration which rather disturbs the economy of the country. After the Paris area, those of the south-east and south-west are the most active. On the other hand, the regions of the north and north-west have the lowest coefficient of utilization."

After dealing with storage practice in France in relation to the common foodstuffs—meat, dairy products, vegetables, fruits, etc.—both as regards chilling and freezing, the author dealt with the development of cold storage according to geographical situation.

On the civil engineering side of the industry, Monsieur Vidal said : " It appears that the tendency is towards construction of ground-floor stores in preference to several floors, especially in areas of production. However, such considerations as difficulties in finding large spaces ; price of the ground ; juxtaposition to older stores built with floors ; still lead to the erection of many of them with several floors. A few isolated innovations are to be noted : For instance slab-floors without capitals to the columns at the cold stores of Limoges and Melnes : elimination of the end column, which lead to end spans in 'porte a faux,' at the cold store of Chalon-sur-Saone. There is a tendency to build rooms higher than formerly, namely, to 4, 6 and 7 metres."

As regards insulation he said : " Until quite recently, pure expanded cork was always the most frequently employed but, because of the question of supplies, cork seems to have been recently replaced by foamed polystyrene. The store ' Loire Atlantique ' of 3,000 m³ at Nantes is entirely insulated by polystyrene. There is often a tendency to leave out insulation between rooms or floors at the same temperature. A barrier to protect the insulating material against dampness is universally made. In recently built stores, great care has been taken to ensure continuity of insulation, notably between floors of rooms and passages, and at the doorways. Further, the passages, the tube ducts, lifts and stairways have been put around the outside of the stores in order to avoid in these spaces condensation and deposits of frost.

" French constructors have put very modern centrifugal compressors at the disposal of their customers but it does not appear that any French cold store is equipped with such machines. Quick-freezing tunnels multiply in number ; they are of diverse types, none of them appearing better than the others."

Problems solved from cold NO.3 IN A SERIES

By Appointment to Her Majesty the Queen
Manufacturers of refrigerating machinery
Pressed Steel Company Limited

How we did three good turns to grocers

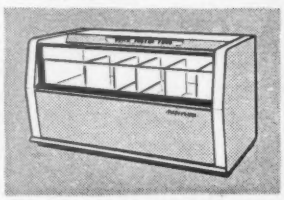
Frozen food — a cabinet problem

Very recently and very rapidly, frozen foods have become big business. It isn't surprising, then, that we learnt a lot about frozen food cabinets. Three main snags have come to light. One: there has been too big a difference in temperature between top and bottom of the cabinet. So either the food at the top isn't cold enough for safety, or, if it is, the food at the bottom is far too cold. Two: the shopper doesn't always get a good view of what's offered. Three: defrosting can be a nuisance to the shopkeeper.

The Prestcold solution — the Farmoor. Prestcold's answer to these problems is the Farmoor—a beautiful sales case, though we say it ourselves. Point one: all the food stays at the correct temperature because the air is always circulating. Cold air flows up the back, across the top, down and underneath again. Point two: the entire front of the storage space is glass, so customers see everything. Point three: the Farmoor does its own defrosting automatically.

Safer storage, quicker sales, less work. To sum it up, the Farmoor is the sort of cabinet a grocer might have designed for himself. It keeps about 600 average size packets of food absolutely safe. Lit from the inside, and with a glass front, it's a standing temptation to the shopper. And, best of all you may think, there's none of the mess and bother of unpacking, defrosting, repacking.

Can Prestcold help you? If you have a problem in refrigeration you'll probably find that existing Prestcold equipment will deal with it. Because all our equipment comes from a long line of intense research. But even if yours is an entirely unique problem please let us know about it. We shall be glad to help. Write to your Prestcold distributor, or to Prestcold Commercial Sales Department, Cowley, Oxford.



The Prestcold Farmoor—an inexpensive £369.0.0. Backed by Prestcold's Sales and Service Organisation. The motor compressor is guaranteed for five years.

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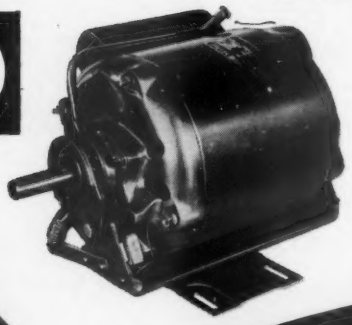
DELCO

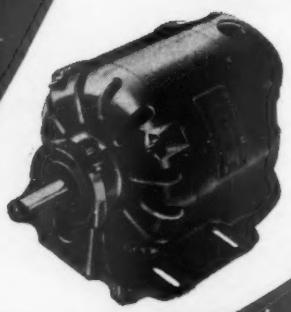
electric motor

DELCO 650 Type



DELCO Hermetic Unit

DELCO 625 Type



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Before you start work on your plans for refrigeration applications which call for compact, high-efficiency electric motors . . . consult Delco Motor engineers.
The Delco range includes motors to meet most modern requirements. These versatile motors are so designed as to be easily adapted to suit your individual needs.

Write for descriptive leaflet featuring motors for use in :—
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Millions of Delco Motors provide reliable power for domestic and industrial applications throughout the world.

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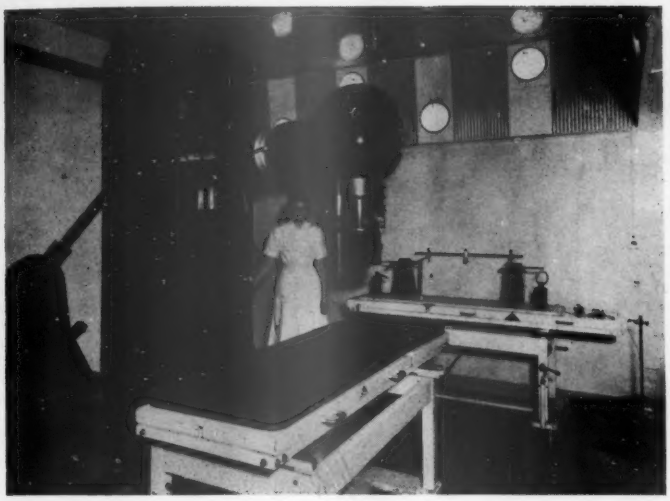


AIR-CONDITIONING A COBALT UNIT THEATRE IN LONDON HOSPITAL

Fig. 1.

THE 20th century has been outstanding for the advances which have been made in all branches of science. This has been reflected in many directions, one of the most notable being the progress made in curing disease and alleviating pain by medicine and surgery, and refrigeration plays a very important part to-day in the activities of doctors and surgeons.

Without doubt, the most spectacular development in recent years has been in the field of nuclear physics and medical science has not been slow in taking advantage of the facilities which this atomic age has to offer, as the following details will show.

Powerful X-ray units have in the past been used for the treatment of malignant growths and deep tumours, covered generally under the name of the number one killer—cancer. These units have their limitations and are very expensive and by comparison, radio-active cobalt is cheap. Moreover, the gamma rays emitted by the isotope " cobalt-60 " are equivalent to the penetration of a 2,000,000-volt X-ray unit.

To the best of our knowledge, there are only two cobalt units in hospitals on this side of the Atlantic and the one to which we are referring was presented to this country by the United States. The authorities here decided it should be installed in one of the leading hospitals in London where doctors from all over the world will have an opportunity of studying this latest development in radio therapy.

The complete equipment is housed in the basement of the hospital where the original brick walls, built in the 17th century, are some 2 ft. thick and so powerful are the radiation effects from the cobalt unit that a further thick concrete lining has been added for protection.

Fig. 1 shows the machine in position over the operating table. The piece of radio-active material, which is quite small, is housed in the spherical head and the bulk of this casting gives some idea of the thickness of metal which is required to protect those who are in close contact with the unit from the radiation effects. It will be observed from the picture that the entire head is provided with micrometer adjustments in all directions and because of these fine settings, it is essential that the machine should be maintained at a constant temperature. It is also necessary to provide comfortable conditions for the operating staff and the very sick patients who are being treated.

In view of this need for constant conditions, the chief architect for the hospital called in the local Frigidaire distributor, Messrs. R. E. A. Bott Ltd., who have supplied refrigeration units to the hospital for various purposes and they obtained the order and installed the air-conditioning plant which is shown in fig. 2.

This consists of a WD6-300 condensing unit operating in conjunction with an extended surface air-cooling coil which dehumidifies and cools the air, which is afterwards tempered through a steam heater to produce constant and comfortable conditions in the room. The air is circulated by means of a silent running centrifugal fan which handles 75 per cent. recirculated air and 25 per cent. fresh filtered air and the complete equipment is controlled automatically from a temperature-sensitive instrument in the operating room.

Rocksil is *resilient* too

ROCKSIL - for either hot or cold insulation — has many important advantages to offer. Probably the most outstanding is its combination of strength with resilience — 'rigid' resilience that absorbs impact and stands up well to considerable deflection of the surface it is protecting. In bonded slab form of various thicknesses and densities this makes Rocksil ideal for casing and structural insulation. It will not settle under continuous vibration even as loose infill. Rocksil is produced from natural Scottish rock and is odourless, chemically inert and sulphur-free, non-hygroscopic and rot-proof.

Rocksil Regd.

ROCK WOOL INSULATION

MANUFACTURED AT STIRLING, SCOTLAND

Full information available from the manufacturers:

THE CAPE ASBESTOS COMPANY LTD.

114 & 116 Park St., London, W.1 Tel: GROsvenor 6022

and at:

Glasgow: Eagle Buildings, 217 Bothwell St., Glasgow, C.2 Tel: Central 2175

Manchester: Floor D, National Buildings, St. Mary's Parsonage, Manchester 3 Tel: Deansgate 6016-7-8

Birmingham: 11 Waterloo St., Birmingham 2 Tel: Midland 6565-6-7

Newcastle: 19 & 20 Exchange Buildings, Newcastle-upon-Tyne Tel: Newcastle 20488

Air-conditioning plant control room in London Hospital.

The cobalt unit can travel up and down the room over the patient and the constant temperature enables adjustments to be made with extreme accuracy in any direction so that the gamma rays can be directed on to a very small area.

The control room for the a-c plant is adjacent to the operating theatre and acts as an air lock to it. When the unit is in operation, the patient is watched through a small observation window of 4-in.-thick leaded glass which protects the operators from the effects of stray radiation. The ducting can be identified in this room by the discharge grilles. This was specially designed by the architect and blends with the very pleasing decoration and finish of both the operating room and the control room.

We acknowledge the help of the editor of Frigidaire News *in preparing this article.*

INSTITUT INTERNATIONAL DU FROID

Technical Board

DURING its annual session of November, 1957, the executive committee of the International Institute of Refrigeration completed the technical board by electing the following vice-presidents :—

Commission 2 :
Prof. C. F. Kayan (U.S.A.)

Commission 4 :
Dr. F. Bramsnaes (Denmark)

Commission 5 :
P. B. Christensen (U.S.A.)

Commission 6 :
Dr. A. S. Parkes (United Kingdom)

Commission 8 :
B. Emilsson (Sweden)

Commission 9 :
Dr. W. R. Woolrich (U.S.A.).

Next Meetings of the Commissions

Commission 1

Scientific problems related to low-temperature physics and thermodynamics. Industries using very low temperatures, rare gases.

Commission 1 will meet in Delft (Netherlands) on June 17, 18 and 20, 1958. The programme of work is as follows :—

Use of liquid hydrogen in industry.
Detection of adulteration caused by low-temperature radiations and effect of dislocations on the physical properties of solids.
Transport phenomena in gases.
Thermometry.

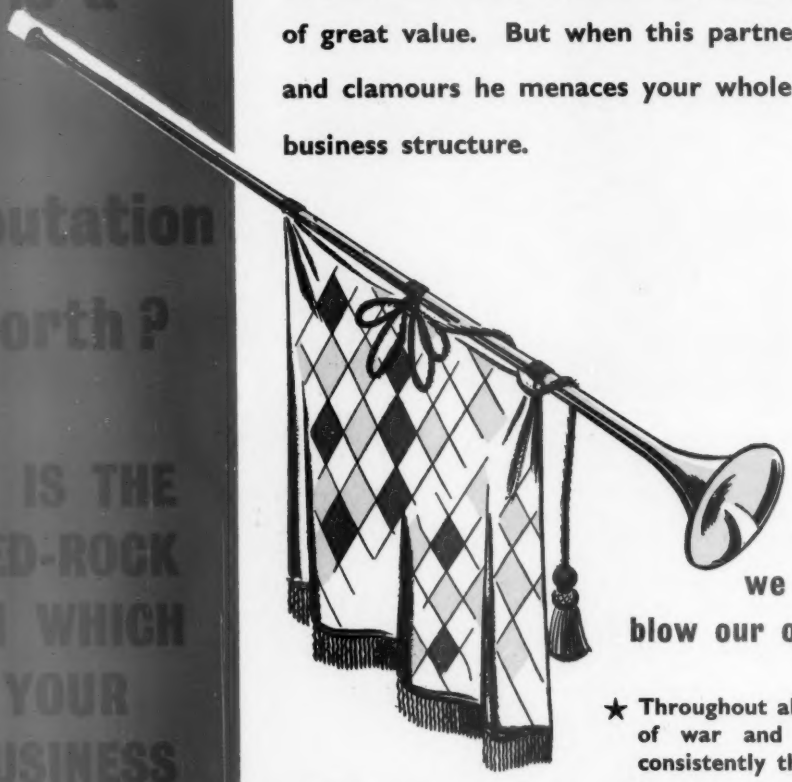
(*Continued on page* 416)

What is a reputation worth?

IT IS THE BED-ROCK ON WHICH YOUR BUSINESS IS BUILT

W. A. TAYLOR LIMITED

INSULATION is the unseen partner in your business : so long as the partner is unobtrusive and renders silent service the association is of great value. But when this partner obtrudes and clamours he menaces your whole business structure.



On this note we unashamedly blow our own trumpet:

★ **Throughout all the vicissitudes of war and its aftermath—consistently the best.**

★ **We do not cut the specification to your price ; we trim our economy and increase our efficiency towards meeting your price, and we welcome a buyer's market.**

★ **Whatever our price, one standard—the best.**

★ **"We never closed"** *(with apologies to the Proprietors of the Windmill Theatre)* **our ears to the smallest complaint.**

Head Office : **PITCAIRN ROAD, MITCHAM, SURREY**
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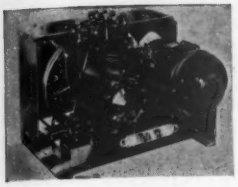
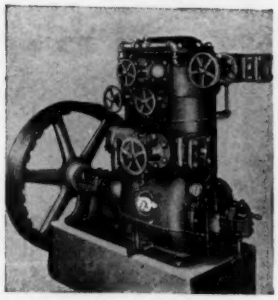
Overseas Insulations (Rhodesia) Ltd., Bulawayo, S. Rhodesia



COMMERCIAL AND INDUSTRIAL SECTION

Manufacturers' and distributors' news



After paying a high tribute to the work of the late Mr. V. A. Patterson —whose passing left a gap which could never be completely filled— Lieut.-Col. Lord Dudley G. Gordon, D.S.O., LL.D., chairman, said at last month's 59th ordinary general meeting of **J. & E. Hall Ltd.**, that Mr. J. D. Farmer, O.B.E., had been appointed deputy chairman and joint managing director. Mr. Farmer came to the company for training as a pupil in 1917 and was appointed a member of the staff in 1920. He was engaged mainly in the marine department and in 1937 he was appointed a director of the company in charge of the marine department and technical matters. As joint managing director he would be responsible for sales of products and for technical functions. Mr. A. Greenfield, M.B.E., had also been appointed joint managing director, responsible for all production and administrative functions. Mr. Greenfield became an apprentice in the firm in 1906, became a member of the staff in 1911 and was appointed a director in 1947 ; he had been engaged in the manufacturing, installation and after-service activities of the company without a break. In past years he had been in control of all the outside refrigerating erection and installation and in charge of the branch works of the company at the main ship-building centres. His great experience would enable him to carry out his duties as joint managing director, said the chairman. Mr. C. R. Croucher had been appointed a director of the company. Mr. Croucher joined the company in 1927, became a member of the staff in 1929 and had been engaged for the past few years on the production side of the works management staff working in very close collaboration with the late Mr. Patterson. His appointment as a director was in accordance with the long established practice of filling vacancies on the board from members of the staff who, by the ability they possessed and the experience they had acquired, were fitted to become a director and assume the more responsible functions of that office. Mr. Croucher as works director would be responsible for the main works and the production drawing office at Dartford.

* * *

We learn from **L. Sterne & Co. Ltd.** that Mr. R. S. Beale, Mr. T. P. Gordon Brown and Mr. E. Elliott, have been appointed directors of the company. Mr. W. R. Houston and Mr. A. Reeves have been appointed divisional directors of the company's hermetic unit division. Mr. E. Walker Elliott retired from the company's service on March 31 after 35 years with the company.

* * *

Two new appointments are announced by **Frigidaire Division** of General Motors Ltd. Kenneth H. Vere, for the last five years the company's sales promotion and advertising manager, has been appointed marketing manager, and R. F. Salter, assistant display manager, has been appointed advertising manager. In addition to his new duties Mr. Vere, who with Mr. Salter took up his new appointment on March 1, will continue to have overall responsibility for the company's sales promotion and advertising while Mr. Salter will retain initial responsibility for displays and exhibitions.

* * *

Five new continental-type coaches, specially equipped as mobile showrooms and carrying a full range of Frigidaire household products, left the factory of **Frigidaire Division** of General Motors Ltd., Kingsbury, London, last month on a tour which will last six weeks and will cover nearly 5,000 miles in England and Wales. Bearing in mind the story of Mahomet and the Mountain, the tour has been designed by the company to assist their dealers by bringing direct to their doorsteps the full range of household products which will be available to them during 1958. To facilitate the most comprehensive coverage the tour has been split into three sections ; the first of these, which started on March 18th, covered dealers residing in the south of England below a line drawn from the River Severn to the Wash. Three weeks later the coaches drove west and north to take in dealers with premises in Wales and the northern counties ; the tour will conclude at the end of April with visits to dealers in the London area.

* * *

In addition to various types of plant for the generation of electrical energy, **The English Electric Co.** will be showing a range of electrical appliances for the home on the B.E.A.M.A. stand in the British Pavilion at the Brussels Exhibition. There will be two refrigerators, specially developed for export markets, as examples of the latest trend in large cabinet design and the table-top size for the smaller kitchen. The English Electric 8·4-c.ft. refrigerator makes use of the inner door panel for storage of eggs, dairy produce, small bottles, and a full-width evaporator and cold drawer give low-temperature storage for frozen packet foods, meat and fish. Unique features in the table-top model include side runners in the cabinet at five different levels so that the rod shelves may be adjusted like those in an oven, and upright storage space for four full-size wine bottles.

* * *

" Do it yourself " is a maxim taken very literally by technicians at the Bognor Regis factory of **Lec Refrigeration Ltd.** and has helped

SEARLE

RADIATORS & REFRIGERATION LTD.

congratulate

MODERN REFRIGERATION

on their 60th Anniversary

ALTHOUGH we were not around in those days we are proud to associate ourselves with the pioneering firms who were.

As specialists in the field of Forced Draught Unit Coolers and Finned Type Coils we look forward to the next 60 years with confidence.

SEARLE RADIATORS & REFRIGERATION LTD.

ARE THE MANUFACTURERS OF

SEARLE-BUSH

UNIT COOLERS

AND ARE MAINLY RESPONSIBLE

FOR THE RAPID ELIMINATION

OF BARE PIPE AND

PLATE TYPE EVAPORATORS

IN ALL MODERN COLDROOMS.

THE AVAILABILITY OF

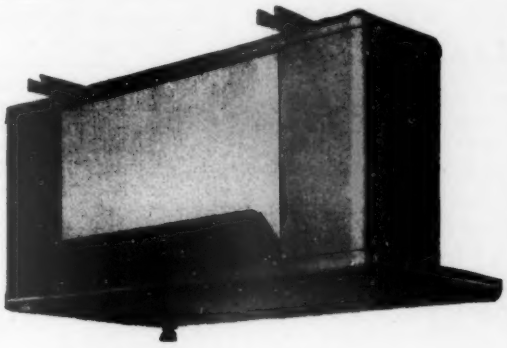
42 STANDARD MODELS

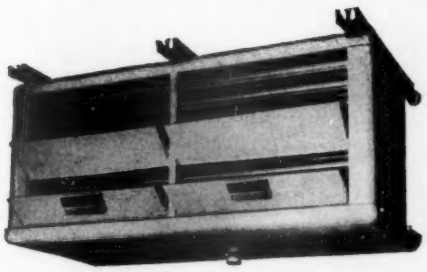
ENABLES YOU TO CHOOSE

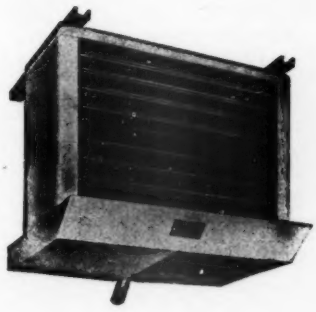
THE CORRECT COOLER

FOR

ANY PARTICULAR APPLICATION







SEARLE **RADIATORS & REFRIGERATION LTD.**

Head Office: BAYHAM STREET, LONDON, N.W.1

EUSton 3242 (P.A.B.X.)

considerably towards the *record production* figures now being achieved. Recently the company introduced a new " baby " refrigerator, the " Coronet," which is the lowest-priced compressor-type model on the home market. In order to keep the price down, production time had to be kept to the minimum and it was realized that if a small multi-spot welder could be obtained (for joining the cabinet shell together and at the same time fusing two runners on the base) three operations could be reduced to one. Many firms were approached but the size was out of the usual run. The price was therefore high and delivery could not be made for many months. Accordingly, Lec's own electricians went to work and after a few weeks made their own machine. Various teething troubles developed, all of which have now been overcome, and the baby multi-spot welder (nicknamed " No-bonus Ernie ") is now working at full pressure. The result? No fewer than 2,000 " Coronets " left Lec's final line in a week, a record number for the company and a credit to all concerned.

* * *

Visco Engineering Co. Ltd.'s new brochure No. 579, " Visco water coolers," which supersedes publication No. 514 published in 1951, has had its text rearranged and slightly modified; a number of new illustrations have been included to show the application of these coolers to many different industries and tables of typical capacities and dimensions are now included.

* * *

Substantial price reductions on the " Frostmaster " automatic electric defrosting device manufactured by the patentees, Heron Heating Devices Ltd., Newcastle-upon-Tyne, were announced recently. The new prices, now effective, apply to a variety of equipment sizes and represent reductions averaging 8 per cent. The device, introduced four years ago to provide automatic electric defrosting on refrigeration forced air evaporator units, is distributed on behalf of the manufacturers by **H. C. Troldahl Ltd.**, of Newcastle-upon-Tyne, and supplied exclusively to Frigidaire Division of General Motors Ltd. for installation in cold rooms, freezer rooms and low-temperature display cases. The reductions have been made possible, despite increased cost of raw materials and labour, by increased volume and manufacturing efficiency. In making the reductions at this time, the companies concerned have also been conscious of the necessity urged upon the country by Her Majesty's Government of keeping prices wherever possible at their lowest level. Examples of the price reductions on some equipment sizes are as follows :—

Model forced air evaporator unit	*Original price*	*Price as from February 1*
SWF.150...	£75 0 0	£70 0 0
SCF.900 ...	£112 0 0	£103 0 0
SFF.103/D	£183 0 0	£169 0 0

* * *

G. A. B. Davidson Ltd., refrigeration specialists of Hanover Street, Edinburgh, have modernized their premises to improve display and presentation. The smaller, older frontage has been replaced by a full plate frontage with hardwood trims and a central decorative door in hardwood. The side area has been given increased window space to allow increased side inspection into the showroom, which has been rearranged without a window base. Space has been considerably increased and display of refrigerated equipment much improved. G. A. B. Davidson Ltd. are Hussmann British agents and are featuring their equipment in this much-improved showroom.

* * *

Mr. D. A. McDonald, chairman of Temperature Ltd., recently undertook an extensive tour of the company's customers and distributors in the Middle East. For these areas, where temperatures of 120° F. are experienced, Temperature Ltd. design and manufacture air-conditioning and refrigerating plant and equipment and have had a steadily increasing volume of sales.

* * *

Claimed to be the biggest vacuum formed refrigerator liner in the world, this giant illustrated above has a capacity of over 13 c.ft. Manufactured by **Clearex Products Ltd.** from approximately $\frac{1}{16}$-in.-thick " Iridon " high impact polystyrene sheeting, the refrigerator liner measures nearly 4 ft. in height, and is over 20 in. deep and 2 ft. across. An " Iridon " liner has the great advantage over the conventional type in that it cannot chip or rust, and an extensive pastel range of colours gives manufacturers an opportunity of satisfying the desires of ever-more-colour-conscious customers. Clearex Products Ltd., who have perfected the special technique which avoids undue thinning of material on large units, made this liner from white " Iridon." Other

features are the pan-formed base and the aperture (top right) which allows access for the evaporator unit. Five bold indents are built into the design ; these avoid the usual metal fittings and will give support to special polythene - coated grids. " Iridon " high-impact polystyrene is supplied by Iridon Ltd., 1, Avery Row, Grosvenor Street, W.1—one of the Commercial Plastics Group of Companies.

* * *

Hotpoint International General Electric Company in the United States has recently developed a line of three entirely new type portable

air-conditioners with up to 8,000 B.t.u. cooling capacities. The new " power plus " units are made in 7½- and 12-ampere models for use on either 115- or 230-volt electric service, and are claimed to be *the smallest and lightest weight 1-h.p. portables ever produced.* Cooling capacity of the 12-ampere units exceeds 8,000 B.t.u., more than double the capacity of other portables. Shipping cartons for the new " power plus " units have handles so the customer can carry the unit home in his car, or take it with the family on vacation. Using adjustable window frames and panels supplied in the carton, the owner can easily install the unit in less than 10 minutes, using only a sharp knife to cut the Fibreglass window panels. The new portable air-conditioners can also be used as room dehumidifiers. After removing the unit from the window, the user simply removes a plug in the bottom of the cabinet. The unit then operates as a room dehumidifier, draining into a container, working at three times the capacity of a regular dehumidifier. A concealed control panel on the front of the unit provides two-speed fan controls, thermostat and an air directional control.

★ ★ ★

Domestic Refrigerators at "Ideal Home"

These informal photographs (and overleaf) were taken by "M.R." at the "Daily Mail" Ideal Home Exhibition, Olympia; they show, top, a corner of the Prestcold Stand on which can be seen right to left: Mr. A. L. Shuttleworth, director, Mr. J. N. Lampson, sales manager, and Mr. K. J. R. Cocke, deputy general manager.

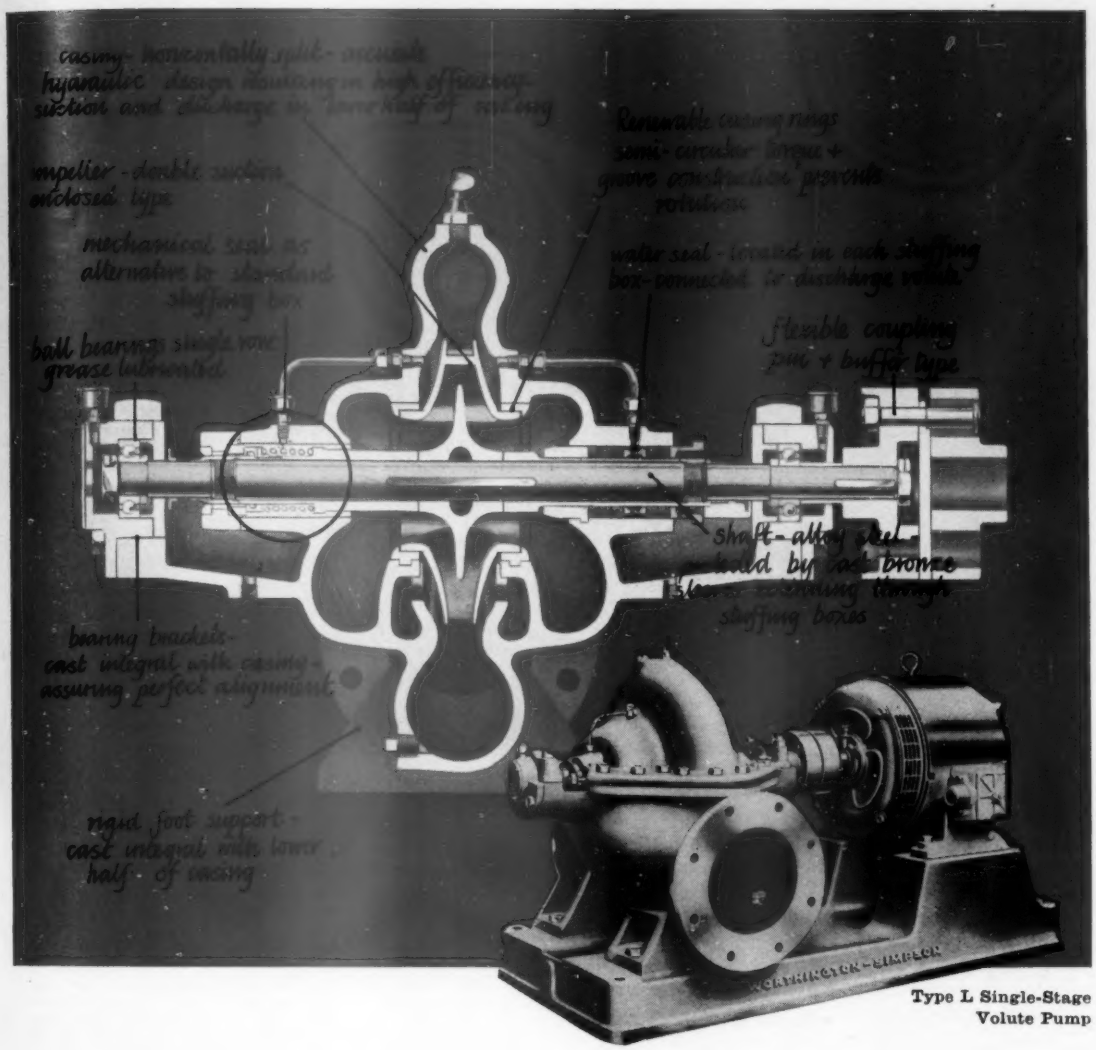
Right is a portion of the Frigidaire display and in the picture are Mr. Kenneth M. Vere, marketing manager, right, Mr. Douglas A. Cole, press officer, Mr. T. Briscoe, household sales, and Mr. Stan Pollard.

The current range of Kelvinator refrigerators can be seen above.

On the right is G.E.C.'s restyled "8."

Cabinet and Frozen Food Display for Retailers

A frozen food fair, attended by 2,000 retailers in the Croydon and south-east London areas, was held in the Croydon showrooms of the South Eastern Electricity Board, and organized by the Maidstone (Kent) and Regent St. (London) branches of Prestcold. It was staged in conjunction with Birds Eye, Smedley's, Eskimo, and Surrey Frozen Foods Ltd., whose stands exhibited a representative range of the industry's products, and the opportunity was taken by Prestcold to feature, in addition to display cabinets, some of the domestic refrigerators in which provision is made for frozen food storage.


casing - horizontally split - provides hydraulic design resulting in high efficiency
suction and discharge in lower half of casing
impeller - double suction enclosed type
mechanical seal as alternative to standard stuffing box
ball bearings single row grease lubricated
Removable casing rings semi-circular torque + groove construction prevents rotation
water seal - located in each stuffing box - connected to discharge casing
flexible coupling pin + buffer type
Shaft - alloy steel
bearing brackets - cast integral with casing - assuring perfect alignment
stuffing boxes
rigid foot support - cast integral with lower half of casing
WORTHINGTON-SIMPSON

Type L Single-Stage Volute Pump

easy access to the interior

Worthington-Simpson single and two-stage horizontal split-casing centrifugal pumps are available in capacities from 15 to 15,000 G.P.M., heads up to 550 feet depending upon capacity. Suction and discharge nozzles are integral with the lower half of the pump, and the upper half can be removed without disturbing shaft alignment or connections. These pumps will operate in series with any type of drive and are particularly suitable for applications where high efficiency and low maintenance costs are required.

Worthington - Simpson Ltd NEWARK NOTTS

P.698

Another view of the fine display at the Croydon electricity showrooms.

REFRIGERATION PATENTS

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the Official *Journal of Patents*, and are published by permission of the Controller of H.M. Stationery Office.

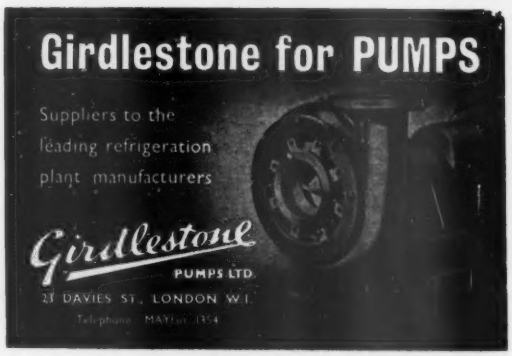
APPLICATIONS RECEIVED

January 31—Electrolux Ltd., P3262, Absorption refrigerating apparatus. February 5—Pellizzetti, I., C3737, Vehicle air-conditioner. 7—Babcock & Wilcox, Ltd., McNaughton, D. and Marskell, W. G., P4152, Thermal insulation. 10—Borkat, P., C4314, Air-conditioning plant humidifier ; Collins, G. J., P4278, Thermal insulating materials. 12—Porter & Co., Ltd., A. Meyer, L. R., P4603, refrigerating apparatus. 20—Carrier Engineering Co., Ltd., C5614, Air-conditioning system, C5616, Air-conditioning units, C5617, Absorption refrigeration machine. 24—Barber-Colman Co. Kennedy, W. W., C5891, Air control damper ; Wolseley Engineering Ltd. Large A. A., P5980, Insulators. 26—Farbwerke Hoechst Akt.-Ges. vorm Meister, Lucius & Bruning, C6299, Refrigerant preparations ; General Electric Co., Ltd., Morric S. H., P6182, Cooling arrangements ; Johnson Equipment Co., G. Zebarth, R. S., C6209, Food products freezing apparatus : Pressed Steel Co., Ltd., Lee J. D. W., P6165, Refrigerators.

COMPLETE SPECIFICATIONS ACCEPTED

February 26—Wilmot-Breeden Ltd., 793,975, Refrigerator or like door fastenings ; Hoyer, O. G., 793,996, Rotary ice-cream brick refrigerators ; General Motors Corporation, 793,688, Refrigeration apparatus. March 5—Stempel-Hermetik Ges., 794,268, Compression type refrigerators. 12—Monsanto Chemical Co., 794,616, Insulating materials ; Dole Refrigerating Co., 794,796 Refrigerating apparatus.

Mr. J. R. King of the firm Middle East Consultants, P.O. Box 1340, Tehran, has advised the British Embassy at Tehran that his company have been asked to advise over the construction, locally, of a 15 storey administrative building which should be completed in about two years time. The new building is for the National Iranian Oil Company. Mr. King is anxious to receive samples and/or information approximate prices from United Kingdom suppliers of a wide range of items including air-conditioners.



I.I.R. News

(*continued from p.* 401)

Further information about these meetings can be obtained from Professor B. S. Blaisse, Mijnbouwplein 11, Delft (Netherlands). The dates and places of these meetings were chosen in order to enable participants also to attend the 6th International Conference on Low-temperature Physics, which will be held in Leiden (Netherlands) from June 23 to 28, 1958.

Commissions 2 and 7

Commission 2 (Heat transmission—thermal properties of materials—measuring devices—insulating materials), and commission 7 (Refrigerated land and air transport) will meet from September 11 to 13, 1958, in Prague (Czechoslovakia).

The following subjects will be dealt with :—

Joint sessions :
- Testing methods of insulated and mechanically cooled vehicles.
- Penetration and accumulation of moisture in the insulation of transport vehicles.

Commission 2 :
- Various properties of insulating materials : comparison of testing methods with a view to standardisation.
- New measuring devices concerning refrigeration techniques (measurement of the flow rates of refrigerants in refrigerating circuits, measurement of low speeds of air circulation, etc.).

Commission 7 :
- Utilization of modern insulating materials in transport vehicles.
- Comparison of the various methods of transporting frozen foodstuffs, from the technical and economic standpoints.
- Effect of pressure heterogeneity outside and inside the vehicles on heat transfer through the walls.

The working sessions will be followed by technical visits from September 15 to 17, 1958.

In order to present papers or to obtain further information intending participants should apply to the presidents of the two commissions :—

Commission 2 :
- Professor P. Lainé, Directeur de la Station Expérimentale du Froid, 4ter, Route des Gardes, Meudon (Seine et Oise) (France).

Commission 7 :
- Dr. Ing. D. Palmieri, Via Novara 43, Rome (Italy).

Commissions 3, 4 and 5

Commission 3 (Design, construction and operation of refrigerating and air-conditioning equipment), Commission 4 (Refrigeration as applied to agricultural and food products) and commission 5 (Refrigerated warehouses and ice factories) will hold a joint session in Moscow from September 3 to 6, 1958.

The subjects to be dealt with are as follows :—

Joint Session of Commissions 3, 4 and 5
- Plants for quick-freezing of foodstuffs : design and technology.

Commission 3
- Automation in industrial refrigerating plants (joint session with commission 5).
- Design and manufacture of extended surface cooling coils.

Commission 4 :
- Freezing of fish.
- Chilling and freezing of meat and poultry.
- Use of antibiotics in conjunction with refrigeration for the preservation of perishable foodstuffs.

Commission 5 :
- Further work on document, " Cold storage guide."
- Design, testing and operation of tunnels and other quick-freezing installations.
- Direct expansion ammonia systems for large refrigerated warehouses.

The working sessions will be supplemented by technical visits.

In order to present papers or to obtain further information one should apply to the presidents of the three commissions :—

Commission 3 :
- Professor P. Glansdorff, Professeur a la Faculté Polytechnique de Mons et a l'Université de Bruxelles, 206, Avenue Montjoie, Bruxelles (Belgium).

Commission 4 :
- Professor, Dr. Ing. J. Kuprianoff, Bundesforschungsanstalt fur Lebensmittelfrischhaltung, Karlsruhe 17a, Kaiserstrasse 12 (Germany).

Commission 5 :
- Ing. J.-B. Verlot, Direction Commerciale de la SNCF, 54, Boulevard Haussmann, Paris (France).

Commission 6

The sub-commission, " Industrial applications of refrigeration," will meet in Karlsruhe (Germany), during the last two weeks of October, 1958.

The session will be devoted to the study of refrigeration as applied to chemical industries. The meetings will be followed by a day devoted to

technical visit in Ludwigshafen (Badische Anilin- und Sudafabrik).

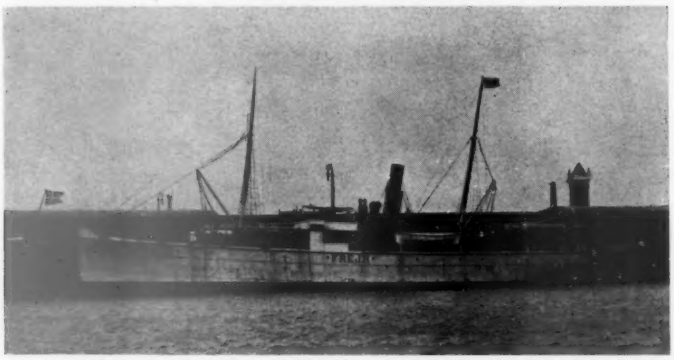
In order to present papers or to obtain further information, apply to the vice-president responsible for the sub-commission : Professor Dr. Ing. K. Nesselmann, Technische Hochschule, Kaiserstrasse 12, Karlsruhe 17a (Germany).

Ths. T. Sabroe

(*continued from p. 363*)

Lately, refrigeration is used to a steadily greater extent for air-conditioning of the accommodation for crew and passengers in ships.

Through the years Sabroe have, besides making various ice-making machines, such as soft-ice machines and scale-ice machines of horizontal and vertical design, included in their manufacturing programme plate freezers for freezing of vegetables and fish.



Left: The first refrigerated ship with Sabroe refrigerating plant (1902).

Below: Sabroe ammonia and "Freon" compressor of the latest high-speed type.

Beyond the use of mechanical refrigeration in dairies and ships the change in Danish agriculture also resulted in the use of artificial cold in the great number of slaughter-houses which sprang up in Denmark in the years after 1900. In this domain, too, Sabroe occupied a leading position.

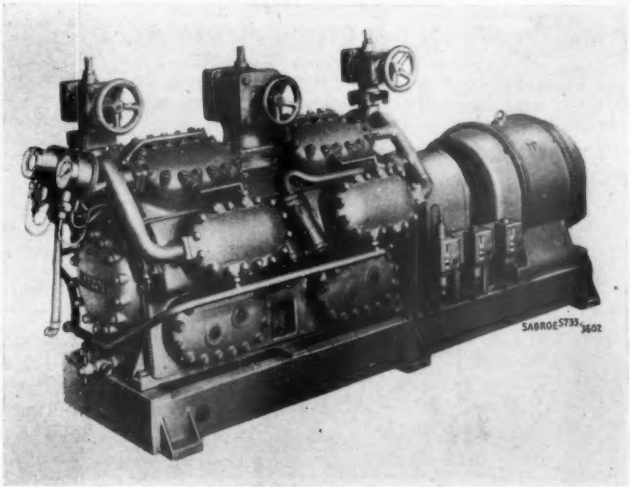
Through the whole "childhood" of refrigeration, carbonic acid especially was used as a refrigerant in dairies and ships ; however, it was not long before ammonia plants gained ground. Sulphur dioxide began to be used as a refrigerant, but it did not really come into use until the small mechanical refrigerating plants started to be installed in butchers' shops, etc.

Carbonic acid held the stage for a very long time as a refrigerant, especially for ships' refrigeration. Not until the years of the second world war and in the years after the war was it replaced partly by ammonia and partly by the new refrigerants " Freon-12 " and " Freon-22 " To-day Sabroe make no new refrigerating plants with carbonic acid as the refrigerant.

Sabroe have participated in the development of the whole range of products of this industry as they started manufacturing small refrigerating plants with sulphur dioxide as a refrigerant ; later on methyl chloride was used and now " Freon-12." Simultaneously, Sabroe have kept up to date in the manufacture of compressors, from the conventional type of compressor to the hermetic and semi-hermetic types. They have had an opportunity also of making some special machines for use within the refrigeration industry. For instance, Sabroe participated in the development of fish freezing by Ottesen's method which gained considerable ground in many countries.

During these years, Sabroe refrigerating compressors have gone through considerable development—from the first CO_2 compressors, on to slow-speed, ammonia compressors to the latest, high-speed, compressors with " Freon " or ammonia as a refrigerant.

Also within the specialized domains of the pharmaceutical industry and science, Sabroe's have had an opportunity of installing a number of refrigerating plants for special pur-



poses, for instance, freeze-drying and deep-freezing to minus 100° C.

During the 60 years in which Sabroe have worked in the field of refrigeration they have gained through practical experience a thorough knowledge of all the sides of the industry, so that to-day they can solve any problem in connexion with the use of cold.

Finally, Sabroe's congratulate MODERN REFRIGERATION on the occasion of their diamond jubilee and express their recognition of the excellent way in which the journal has kept the refrigeration industry informed of developments in all its sections.

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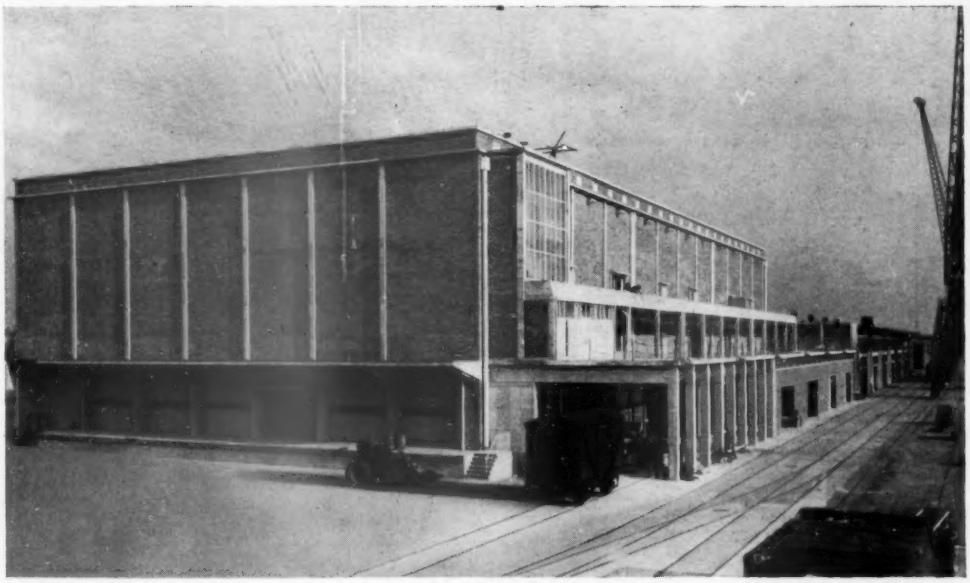
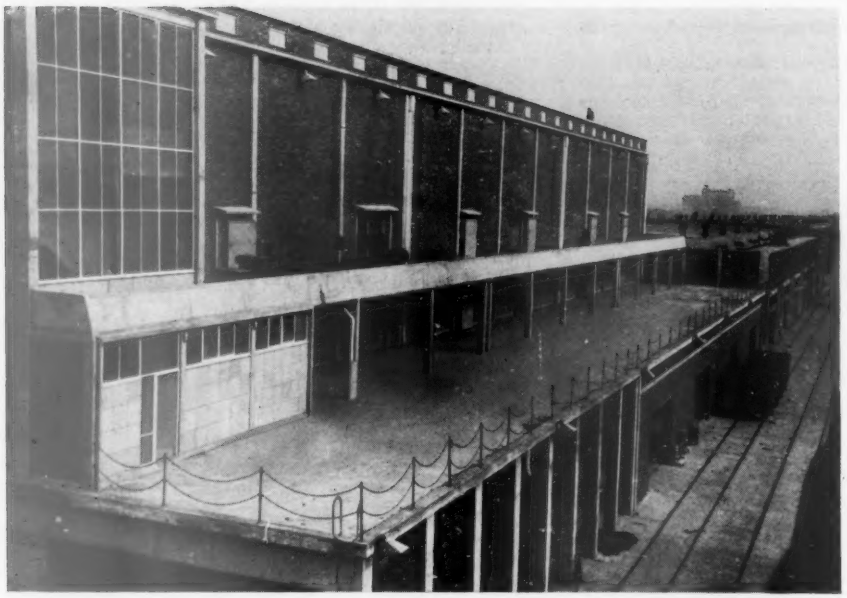
Our historical survey will be completed in the May issue. The next instalment includes descriptions of Continental and U.S. machine firms and British insulation companies



New Southampton Store is a Model Building for Goods Handling

MANY readers will recall, indeed a few may have witnessed, the destruction by enemy action in 1940 of the great refrigerated premises operated by The International Cold Storage Co. Ltd. on the dockside at Southampton. For two weeks the vast building, which was loaded with butter, blazed after being hit by the Luftwaffe.

Southampton, the premier passenger port of the United Kingdom, is also one of the six leading cargo ports of Great Britain, but since the destruction of the International cold store there has been a lack of cold storage space for refrigerated cargoes on the docks. This deficiency in cold storage space caused by that tragic blow 18 years ago has now



The extremely ample reception balconies are clearly seen here.

been made good by the erection of a new colossus of imposing elevation at the western end of the new docks system, namely, at berth 108, new docks. There are many striking features about the new store which has been built by The British Transport Commission and leased to the International Company.

Perhaps the most outstanding characteristic of the new building is its ability to receive into store from ship, freight train and road transport—all at the same time, if need be. This applies also to the discharge of produce. These handling facilities are quite unique in Great Britain.

There are rail tracks on either side of the building and one actually runs through the premises while the western end is completely given over to a road vehicle bank with mechanically operated " up-and-over " doors ; 10 vehicles can operate here simultaneously.

The cold store has been built on the quayside which, with a minimum depth of 40 ft. of water, is approachable by the largest liners at all times. The store has four floors of which the ground floor has been designed as a transit shed for general cargoes. Adjacent is the 108 berth transit shed, so that freight and passengers can be dealt with simultaneously.

The first and second floors have been fully insulated and have a total capacity of 419,000 c.ft. Each of the two floors is divided into six separate chambers. Direct expansion refrigeration, by roof grids, has been installed in all rooms on the first floor while four chambers on the second floor have air coolers ; the remaining two have wall and ceiling grids. This arrangement allows a range of temperatures from minus 20° to plus 45° F. to be provided, so that different commodities can be stored at their appropriate temperature and humidity.

On the waterside elevation of the building there are receiving balconies running the full length of both floors which enables refrigerated cargo to be discharged direct from the hold on to the balconies and thence, in a matter of minutes, to be under refrigeration again in the cold store. There are two entrances into each cold chamber from the balconies.

The third floor has not yet been insulated but should this be required it could provide another 220,000 c.ft. of cold storage space.

All four floors are served by electric lifts by which produce can be delivered quickly to rail and road vehicles at the covered loading bays.

Southampton's quayside is extremely well fitted with cranes and these are capable of plumbing ships holds and delivering direct to the cold store or transit shed or to rail and road vehicles alongside.

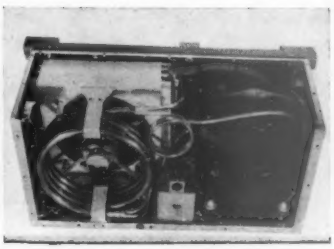
Construction of this imposing building was by Sir Robert McAlpine & Sons Ltd.

It is intended to include at a later date a full description of the internal disposition of chambers and machinery.

FURTHER COMMERCIAL ITEMS

Temperature Ltd., of London, S.W.6—who claim to be the largest producers of air-conditioning units outside the U.S.A.—have recently introduced a nominal 1-h.p., hermetically sealed and *water-cooled* "Tropical" room air-conditioner, designed for use in the hot countries with relatively high humidities. It is for air-conditioning new and existing buildings, is unobtrusive and

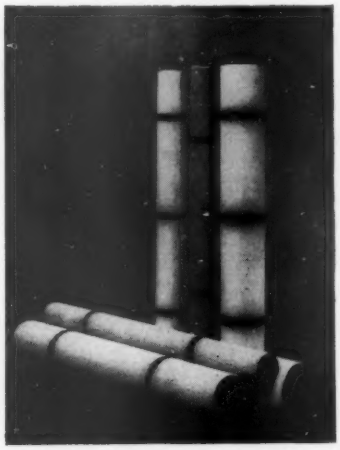
can be installed without spoiling the appearance of building fascias by undesirable protrusion of room cooler exteriors. Overall dimensions of this nominal 1-ton (refrigeration) machine are only 11 in. deep, 28 in. wide, and 14 in. high. The three-row semi-contraflow evaporator is designed for maximum moisture



removal and air cooling. The Sternette-Tecumseh B.1616 or B.1516 single - phase motor compressor absorbs only 1,200 watts (6 amps. approximately) and is specifically wound for 50- or 60-cycle duty. The cleanable, circular, double-pipe contraflow condenser, is constructed as a finned tube within a copper pipe. When used in humid atmospheres, uninsulated, it provides reheat. An air-inducted, electro-static, washable air filter and thermostat are fitted. The sheet metal case is efficiently corrosion-proofed and the fascia plate is in plastic. Two knurled screws facilitate removable for inspections and servicing. Draftless air distribution is achieved by the provision of a circular, adjustable air grille. Each unit is subjected to a six-hour test under tropical conditions, before dispatch, in accordance with Temperature Ltd. standard procedure. List price of the "Tropical" is £132.

* * *

The presentation on a single stand (No. 20, Grand Hall Gallery) of "Caposite" asbestos and "Rocksil" rock wool thermal insulation materials, "Vermiculux" fire-proofing concrete, "Asbestolux" building board, "Capasco" brake and clutch linings, asbestos textiles and cements, packings, jointings and millboard,



"Rocksil" rigid pipe sections.

all manufactured by **The Cape Asbestos Co. Ltd.** and its subsidiaries, will give visitors to the Chemical and Petroleum Engineering Exhibition at Olympia (June 18 to 28) an impressive idea of the exceptionally strong position this company is in to provide the oil industry with a unique, comprehensive service in this field. Apart from manufacture, the company undertakes the fitting of insulation, and details of the work of the company's contracts department, together with technical advice and literature, will be given on the stand.

Frostaire Expand

We learn that **Frostaire Refrigeration Co. Ltd.** are continuing their expansion by purchasing a factory on a freehold basis ; it is a two-storey building together with all surrounding land amounting to approximately 10,000 sq.ft. situated at Barnet on the St. Albans Road. These factory premises will be used to hold a greater degree of stock which in turn will enable the firm to quote and effect immediate delivery of any orders that may be

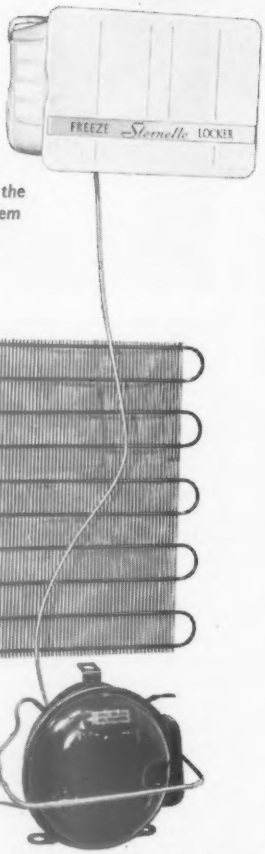
Mr. L. L. Amesbury, managing director, Frostaire.

received during the coming season. The ground floor of the building will be allocated to new stock storage and warehousing, leaving the first floor available for condensing units and smaller assembly work. Frostaire have been allocated the Marco distributorship stretching out as far as Ware and Harpenden, cutting a line straight through to Watford, including St. Albans ; the new factory will, therefore, prove useful as a service centre for refrigeration units in that area for Barnet is approximately eight miles from the present headquarters at Muswell Hill going in a Northwood direction. The new premises are in addition to the existing premises and warehouse at Edgeware and Risboro Court and will prove invaluable to this company, bearing in mind the very large expansion programme on hand at the present time.

6 GOOD POINTS FOR BUYING...

Sternette

DOMESTIC CABINET SYSTEMS



Illustrated is the Sternetic System Model 57.U (5.7 cu. ft.)

1. **Large capacity deep freeze storage.**
2. **Available with beautifully styled doors.**
3. **Powered by the famous Tecumseh Pancake Unit.**
4. **Instant release flexotrays.**
5. **New roll bonded aluminium evaporators.**
6. **Hermetic Unit covered by five year guarantee.**

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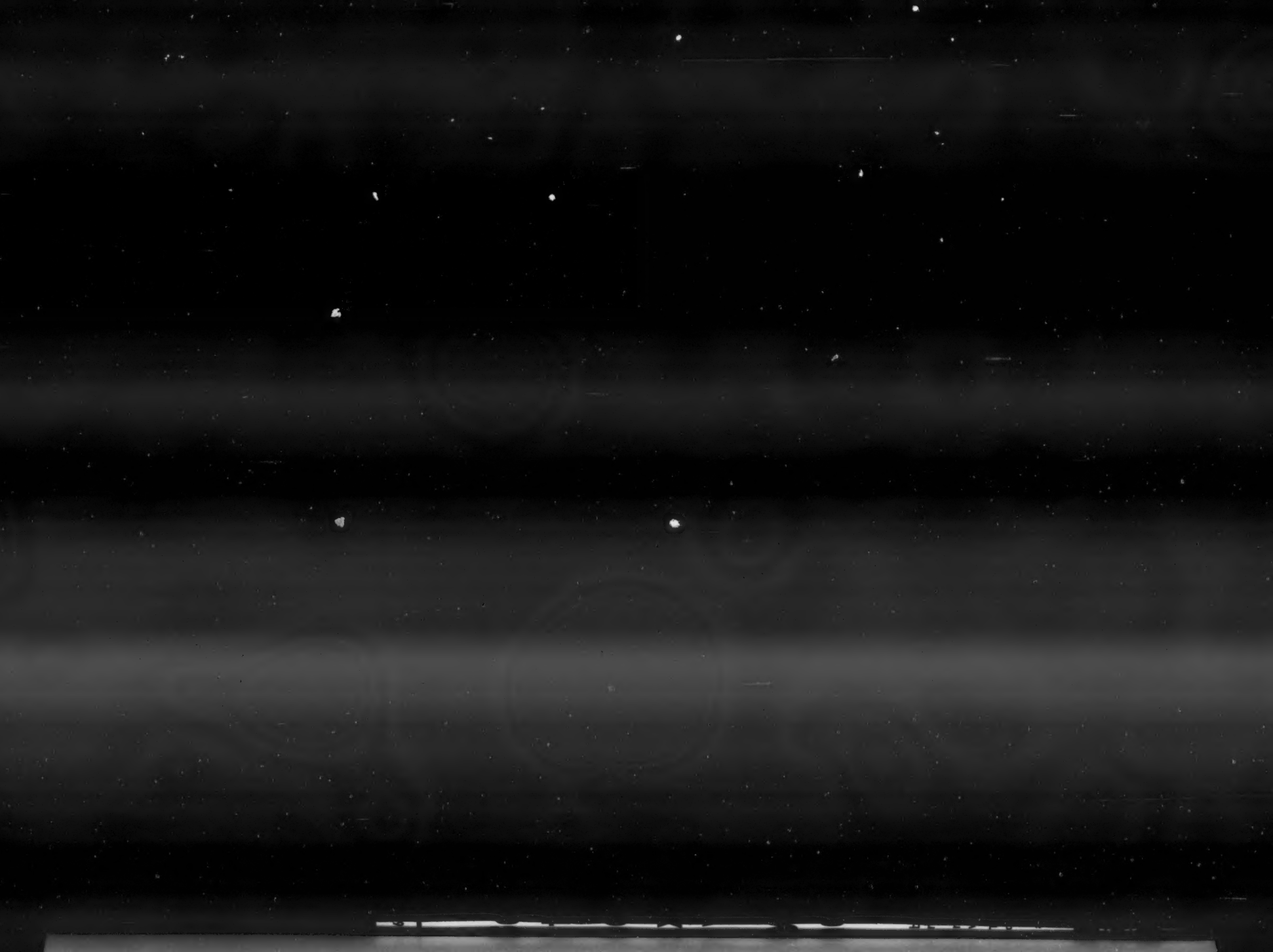
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